ASTRONOMY
TL
501
.S42
v. 11
no. 17

OCT 4 1973

Room use
only

Scientific and Technical Aerospace Reports

OCT 3 1973
The University
of Michigan
Astronomy
Library

A SEMIMONTHLY ABSTRACT JOURNAL WITH INDEXES

Astronomy

SEPTEMBER 8, 1973

VOLUME 11 • NUMBER 17

N73-25997 — N73-26989

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PURCHASE OF *STAR*

The semimonthly issues and the cumulative index issues are available postpaid on subscription and in single copy from the Superintendent of Documents, United States Government Printing Office, Washington, D.C. 20402, United States of America.

Semimonthly issues. . .

Annual subscription rate: $118.00, domestic; $147.50, foreign. Price per single copy: $5.00, domestic; 25% extra for foreign mailing.

Cumulative index issues. . .

Annual subscription rate: $37.50, domestic; $47.00, foreign. Price per single copy varies according to the number of pages.

Domestic subscription rates. . .

Apply to the United States, Canada, Mexico, and all Central and South American countries, except as noted below.

Foreign subscription rates. . .

Apply to Argentina, Brazil, French Guiana, Guyana, Surinam, British Honduras, and all other countries throughout the world.

Payment should be by check, money order, or document coupons, and must accompany order. Remittances from foreign countries should be made by international money order or draft on an American bank, payable to the Superintendent of Documents, or by UNESCO book coupons.

PUBLISHED BY:
UNITED STATES GOVERNMENT
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
SCIENTIFIC AND TECHNICAL INFORMATION OFFICE
Scientific and Technical Aerospace Reports, Volume 11, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Tisco, Inc.

The Administrator of the National Aeronautics and Space Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through April 1, 1974.

INTRODUCTION

A COMPREHENSIVE INFORMATION SERVICE

The National Aeronautics and Space Administration makes the results of worldwide research and development activities in aeronautics, space, and supporting disciplines promptly available to participants in its programs. NASA's scientific and technical information system now contains nearly a million documents, which are abstracted, indexed, and obtainable through retrieval and dissemination services. These services, which include this abstract journal, *Scientific and Technical Aerospace Reports (STAR)*, are described in a bulletin, *The NASA Scientific and Technical Information System . . . and How to Use It*, available at no charge from the NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Maryland 20740.

STAR—A REPORT ABSTRACTING SERVICE

STAR is a comprehensive abstracting and indexing journal covering current worldwide *report* literature on the science and technology of space and aeronautics. Publications abstracted in *STAR* include scientific and technical reports issued by NASA and its contractors, other U.S. Government agencies, corporations, universities, and research organizations throughout the world. Pertinent theses, translations, NASA-owned patents and patent applications, and other separate documents are also abstracted. Citations and abstracts in *STAR* are grouped in 34 subject categories, although accession numbers run in unbroken sequence through the *STAR* issues, without regard to category assignment.

Certain publications abstracted in *STAR* are given analytic treatment, with citations and abstracts of daughter items following immediately after the parent document. When the subject content of a daughter differs from that of its parent, a cross-reference citation is printed at the end of the category to which the daughter would normally have been assigned.

Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

STAR, issued on the 8th and 23rd of each month, is available to the public on subscription from the Superintendent of Documents, U.S. Government Printing Office, as noted on the inside cover. *STAR* is sent without charge to qualified organizations registered with NASA as described in the paragraph *Eligibility and Registration for NASA Information Products and Services*.

ABSTRACTS OF NONREPORT LITERATURE

By arrangement between NASA and the American Institute of Aeronautics and Astronautics, the AIAA publication *International Aerospace Abstracts (IAA)* provides parallel coverage of scientific and trade journals, books, and conference papers in the same subject areas as *STAR*. *STAR* and *IAA* are categorized and abstracted in basically identical ways, and documents in both are indexed by terms from the *NASA Thesaurus*. Both journals appear twice monthly, *IAA* being issued on the 1st and 15th of each month.

IAA is available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, NY 10017, at the following annual rates:

Semimonthly issues: United States and possessions, $110 postpaid; foreign countries, $125 postpaid.

Cumulated index volumes: United States and possessions, $75 postpaid; foreign countries, $90 postpaid.

ANNOUNCEMENT OF NASA PUBLICATIONS IN STAR

Scientific and technical reports produced by NASA and its contractors and grantees, or in conjunction with other Government agencies, and other selected documents released by NASA are identified by an asterisk (*) following the accession numbers (e.g., N73-10205*). Prior to their announcement in *STAR*, these NASA publications are assigned a specific NASA report number, which is shown on the last line of the *STAR* citation. The nature of NASA publications is specified by the report number series, identified by a prefix to the report number: TR-R, TN-D, TM-X, TT-F, CR, or SP. These series refer respectively to NASA Technical Reports, which contain significant and complete contributions to scientific and technical knowledge; Technical Notes, reports of similar quality but lesser scope; Technical Memorandums, reports containing preliminary data or of specialized utility; Technical Translations, information published in a foreign language and considered to merit NASA distribution in English; Contractor Reports, information generated under NASA-sponsored contracts, grants, or interagency agreements; and Special Publications, which include conference proceedings, monographs, data compilations, sourcebooks, special bibliographies, and other publications derived from or of value to NASA activities. Reports in these series that are printed by NASA are often referred to as "low-numbered" or "low series" publications, because the report number is always below 50,000 (8,000 for Technical Translations). Some TM-X and CR reports are numbered above 50,000. These, and TT-F translations above 8,000, are referred to as "high-numbered" or "high series" publications, and are generally available only in microfiche[1] or facsimile reproductions.

DISTRIBUTION OF NASA PUBLICATIONS

NASA distributes its publications to qualified recipients who have registered as described in the next paragraph. (Public availability of NASA reports and other publications announced in *STAR* is discussed separately in this Introduction.) Automatic distribution of low series NASA reports can be made in either paper (printed) copy or microfiche. High series NASA reports are given automatic distribution only as microfiche. The automatic distribution of a NASA report, in paper copy and/or microfiche, is made under the same subject category in which it is announced in *STAR*. A printed low series report usually is disseminated four to six weeks prior to its announcement in *STAR*. Microfiche of both low and high series reports are disseminated concurrently with *STAR* announcement. Automatic distribution of NASA documents is supplemented by a secondary request service, usually for microfiche copy only, which NASA may provide to qualified registrants.

ELIGIBILITY AND REGISTRATION FOR NASA INFORMATION PRODUCTS AND SERVICES

A variety of services, in addition to the distribution of NASA scientific and technical reports and of *STAR* and its cumulative indexes, is available to organizations of the following types that have registered with NASA to receive specific services or products:

1. NASA offices, research centers, contractors, subcontractors, grantees, and consultants;
2. Other U.S. Government agencies and their contractors;
3. Libraries in the United States that have arrangements with NASA to maintain collec-

(1) A microfiche is a transparent sheet of film, 105 by 148 mm in size, containing as many as 60 to 98 pages of information reduced to micro images (not to exceed 24:1 reduction).

tions of NASA documents for public reference;

4. Other organizations in the United States having a need for NASA documents in work related to aeronautics and space research;
5. Organizations abroad that have established reciprocal document exchange arrangements with NASA.

Only the central service points or central points of document acquisition and control within qualified organizations are eligible to register for NASA products and services.

Domestic organizations that may be eligible to receive various classes of NASA publications and services should address their requests for registration or for further information to:

NASA Scientific and Technical Information Facility
Attn.: Registration Activity
P.O. Box 33
College Park, MD 20740

Organizations abroad should direct requests to the same address, but to the attention of: Foreign Exchange and Acquisitions Branch.

PUBLIC AVAILABILITY OF DOCUMENTS ANNOUNCED IN STAR

The source of documents announced in *STAR* varies, depending upon the organization which has issued a document and the form in which the document can be provided. Those documents that can be obtained on microfiche are indicated in *STAR* by the # symbol following the NASA accession number. All documents for which microfiche can be obtained are also available as facsimile.

Documents that cannot be microfiched but for which one-to-one facsimile can be provided are indicated by a plus (+) instead of the # sign. Documents for which neither the + nor # symbol is shown, and for which no availability other than the issuing activity is given, may present unusual problems of reproducibility. The originator of such a document should be consulted as to its availability.

A source from which a document announced in *STAR* is available to the public is ordinarily given on the last line of the citation. The NASA accession number is sufficient when ordering NASA and NASA-sponsored documents (indicated by an asterisk) from the National Technical Information Service. When ordering non-NASA documents (no asterisk) from the issuing agency or other sources, particularly NTIS, it is essential that additional bibliographic information, including the report number, be given.

The following are the most commonly indicated sources: (Full addresses of these organizations are listed at the end of this introduction.)

Avail: NTIS. Sold by the National Technical Information Service as indicated:

Currently Announced Documents. Facsimile (reproduced on demand) copies are sold for $3.00 plus 25 cents for every 5 pages over 20 pages, effective for all documents having the accession number N72-22991 (the first accession in 1972 *STAR* 14) or higher. The full price is shown in the citation.

Printed NASA Documents. Documents such as NASA Technical Reports, Technical Notes, Special Publications, Contractor Reports, Technical Memorandums (numbered below 50,000), and Technical Translations (below 8,000) are priced at $3.00 for documents of 300 pages or less; $6.00 for those in the 301-600 page range; $9.00 for those having 601-900 pages; and individually priced above 900 pages. Documents available from both the Superintendent of Documents (SOD), Government Printing Office, and from NTIS have the SOD price. All prices are shown in the citation. See page vi for NTIS printed document subscription rates.

Documents Announced Between July 1970 and July 1972. All documents with accession numbers between N70-27805 and N72-22990 are sold at the previously announced standard price, whether printed copy or facsimile is supplied. If "Avail: NTIS" appears in the citation, the document is sold at $3.00. Any other price is shown in the citation.

Documents Announced Prior to July 1970. A surcharge of $3.00 is applied to each document that, as of STAR Issue 14, 1972, is two years old from the time of its announcement, i.e., to all documents with an accession number lower than N70-27805 (the first accession number in Issue 14, 1970, of *STAR*), but not to more recently issued documents. Therefore, documents with older accession numbers of 300 pages or less are priced at a total of $6.00. Since no surcharge is applied to documents with over 300 pages, documents in the 301- to 600-page range are also sold for $6.00 in hard copy, and those in the 601- to 900-page range are sold at $9.00. Those exceeding 900 pages are priced by NTIS on an individual basis, except when priced by SOD. These prices do not change with time.

Microfiche. Microfiche is available from NTIS at a standard price of 95 cents (regardless of age) for those documents identified by the # sign following the accession number (e.g., N73-10242#) and having an NTIS availability shown in the citation. Standing orders for microfiche of (1) the full collection of NTIS-available documents announced in *STAR* with the # symbol, (2) NASA reports only (identified by an asterisk (*)), (3) NASA-accessioned non-NASA reports only (for those who wish to maintain an integrated microfiche file of aerospace documents by the "N" accession number), or (4) any of these classes within one or more *STAR* categories, also may be placed with NTIS at greatly reduced prices per title (e.g. 38 cents) over individual requests. These availabilities apply only to microfiche with the standard 95-cent price; any document with a different cited price must be purchased individually at that price. Inquiries concerning NTIS Selective Categories in Microfiche should be addressed to the Subscription Unit, National Technical Information Service.

Deposit Accounts and Customers Outside U.S. NTIS encourages its customers to open deposit accounts to facilitate the purchase of its documents now that prices vary so greatly.

NTIS customers outside the United States are reminded that they should add the following handling and postage charges to the standard or announced prices: hard (paper) copy, $2.50 each document; microfiche, $1.50 each document. For subscribers outside the United States who receive microfiche through the Selective Categories in Microfiche program, NTIS will add 15 cents for each title shipped.

Avail: SOD (or GPO). Sold by the Superintendent of Documents, U.S. Government Printing Office, in hard copy. The price and order number are given following the availability line. (An order received by NTIS for one of these documents will be filled at the SOD price if hard copy is requested. NTIS will also fill microfiche requests, at the standard 95 cent price, for those documents identified by a # symbol.)

Avail: NASA Public Document Rooms. Documents so indicated may be examined at or purchased from the National Aeronautics and Space Administration, Public Documents Room (Room 126), 600 Independence Ave., S.W., Washington, D.C. 20546, or public document rooms located at each of the NASA research centers, the Mississippi Test Facility, and the NASA Pasadena Office at the Jet Propulsion Laboratory.

Avail: NASA Scientific and Technical Information Office. Documents with this availability are usually news releases or informational leaflets available without charge in paper copy.

Avail: AEC Depository Libraries. Organizations in U.S. cities and abroad that maintain collections of U.S. Atomic Energy Commission reports, usually in microfiche form, are

listed in *Nuclear Science Abstracts*. Services available from the USAEC and its depositories are described in a booklet, *Science Information Available from the Atomic Energy Commission* (TID-4550), which may be obtained without charge from the USAEC Technical Information Center.

Avail: Univ. Microfilms. Documents so indicated are dissertations selected from *Dissertation Abstracts* and are sold by University Microfilms as xerographic copy (HC) at $10.00 each and microfilm at $4.00 each regardless of the length of the manuscript. Handling and shipping charges are additional. All requests should cite the author and the Order Number as they appear in the citation.

Avail: USGS. Originals of many reports from the U.S. Geological Survey, which may contain color illustrations, or otherwise may not have the quality of illustrations preserved in the microfiche or facsimile reproduction, may be examined by the public at the libraries of the USGS field offices whose addresses are listed in this Introduction. The libraries may be queried concerning the timely availability of specific documents and the possible utilization of local copying services (e.g., color reproduction).

Avail: HMSO. Publications of Her Majesty's Stationery Office are sold in the U.S. by Pendragon House, Inc. (PHI), Redwood City, California. The U.S. price (including a service and mailing charge) is given, or a conversion table may be obtained from PHI.

Avail: BLL (formerly NLL): British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. Photocopies available from this organization at the price shown. (If none is given, inquiry should be addressed to the BLL.)

Avail: ZLDI. Sold by the Zentralstelle für Luftfahrtdokumentation und -Information, Munich, Federal Republic of Germany, at the price shown in deutschmarks (DM).

Avail: Issuing Activity, or Corporate Author, or no indication of availability. Inquiries as to the availability of these documents should be addressed to the organization shown in the citation as the corporate author of the document.

Avail: U.S. Patent Office. Sold by Commissioner of Patents, U.S. Patent Office, at the standard price of 50 cents each, postage free. (See discussion of patents and patent applications below.)

Other availabilities: If the publication is available from a source other than the above, the publisher and his address will be displayed entirely on the availability line or in combination with the corporate author line.

EUROPEAN AVAILABILITY OF NASA AND AGARD DOCUMENTS

Facsimile copy or microfiche of NASA and NASA-sponsored documents identified by both the symbols # and * and those AGARD reports that are on microfiche may be purchased from:

ESRO/ELDO Space Documentation Service
European Space Research Organization
114, av. Charles de Gaulle
92-Neuilly-sur-Seine, France

NASA PATENTS AND PATENT APPLICATIONS

Patents and patent applications owned by NASA are announced in *STAR* under appropriate subject categories and are referenced in the *STAR* indexes. In the Report/Accession Number Index, patents are indexed by the NASA Case Number (which appears in lieu of the report number in other indexes), the U.S. Patent Number, the U.S. Patent Application Serial Number, and the U.S. Patent Class. Patent applications for which patents have not yet been issued are indexed by the NASA Case Number and the U.S. Patent Application Serial Number.

NASA *patent application specifications* are sold by the National Technical Information Service at the price shown in the citation. Microfiche are sold at the established unit price of 95 cents. The US-Patent-Appl-SN- number should be used in ordering either paper copy or microfiche

from NTIS. Printed copies of *patents* (which are not microfiched) are available for purchase at 50 cents per copy from:

Commissioner of Patents
U.S. Patent Office
Washington, DC 20231

When ordering patents, the U.S. Patent Number should be used, and payment must be remitted in advance, preferably by money order or check payable to the Commissioner of Patents. Prepaid purchase coupons for ordering are also available from the Patent Office. The patents and patent applications announced in *STAR* are owned by NASA and are available for royalty-free licensing. Requests for licensing terms and further information should be addressed to:

Assistant General Counsel for Patent Matters/Code GP-1
National Aeronautics and Space Administration
Washington, DC 20546

COSATI SUBJECT CATEGORY CODE

In the citation of each NASA-supported document and of some non-NASA documents is a code (e.g., CSCL 25A) that indicates the subject category assigned to it from the COSATI Subject Category List (first ed. December, 1964) published by the Committee on Scientific and Technical Information of the Federal Council for Science and Technology.

INDEXING VOCABULARY

The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

SUBSCRIPTION TO NASA PRINTED DOCUMENTS

The National Technical Information Service offers an annual subscription to printed NASA formal series reports at a per-title price, including handling and postage, of $2.00 domestic, $2.50 foreign. (There are no added charges beyond this for subscribers outside the United States.) About 1,000 titles are printed yearly; all must be subscribed to. Included are NASA Technical Reports, Technical Notes, Special Publications (including those printed by the Government Printing Office), Contractor Reports numbered below CR-50,000, Technical Memorandums numbered below TM-X-50,000, and Technical Translations numbered below TT-F-8000. Excluded are NASA patents, Technology Utilization publications (SP-5000 series), NASA continuing bibliographies (SP-7000 series), and Space Vehicle Design Criteria (SP-8000 series). (Continuing bibliographies can be purchased from NTIS on yearly subscription for specific titles and supplements or on an individual-title basis, while the TU and SVDC publications are sold by NTIS only on an individual report basis.) For additional details on subscriptions, inquiries should be directed to NTIS.

ADDRESSES OF ORGANIZATIONS

American Institute of Aeronautics
and Astronautics
Technical Information Service
750 Third Ave.
New York, N.Y. 10017

British Library Lending Division,
Boston Spa, Wetherby, Yorkshire,
England

Commissioner of Patents
U.S. Patent Office
Washington, D.C. 20231

Engineering Sciences Data Unit Ltd.
251–259 Regent Street
London W1R 7AD, England

ESRO/ELDO Space Documentation Service
European Space Research Organization
114, av. Charles de Gaulle
92-Neuilly-sur-Seine, France

Her Majesty's Stationery Office
P.O. Box 569, S.E. 1
London, England

NASA Scientific and Technical Information
Facility
P.O. Box 33
College Park, Maryland 20740

National Aeronautics and Space
Administration
Scientific and Technical Information
Office (KSI)
Washington, D.C. 20546

National Technical Information Service
Springfield, Virginia 22151

Pendragon House, Inc.
899 Broadway Avenue
Redwood City, California 94063

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

University Microfilms
A Xerox Company
300 North Zeeb Road
Ann Arbor, Michigan 48106

University Microfilms, Ltd.
Tylers Green
London, England

U.S. Atomic Energy Commission
Technical Information Center
P.O. Box 62
Oak Ridge, Tennessee 37830

U.S. Geological Survey
1033 General Services Administration Bldg.
Washington, D.C. 20242

U.S. Geological Survey
601 E. Cedar Avenue
Flagstaff, Arizona 86002

U.S. Geological Survey
345 Middlefield Road
Menlo Park, California 94025

U.S. Geological Survey
Bldg. 25, Denver Federal Center
Denver, Colorado 80225

Zentralstelle für Luftfahrtdokumentation und -Information
8 München 86
Postfach 880
Federal Republic of Germany

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page

01 Aerodynamics 1979
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 1980
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 1985
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 1986
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 1988
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 1991
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 1993
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

page

08 Computers 2000
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 2003
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 2007
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 2008
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 2012
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 2016
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 2030
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 2036
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 2039
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic 2042
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

page

18 Materials, Nonmetallic 2048
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 2054
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 2056
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 2059
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 2061
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 2062
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation.

24 Physics, Atomic, Molecular, and Nuclear 2064
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

25 Physics, Plasma 2066
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

26 Physics, Solid-State 2070
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

27 Propellants 2075
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

28 Propulsion Systems 2076
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 2079
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 2080
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 2086
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 2090
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 2096
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

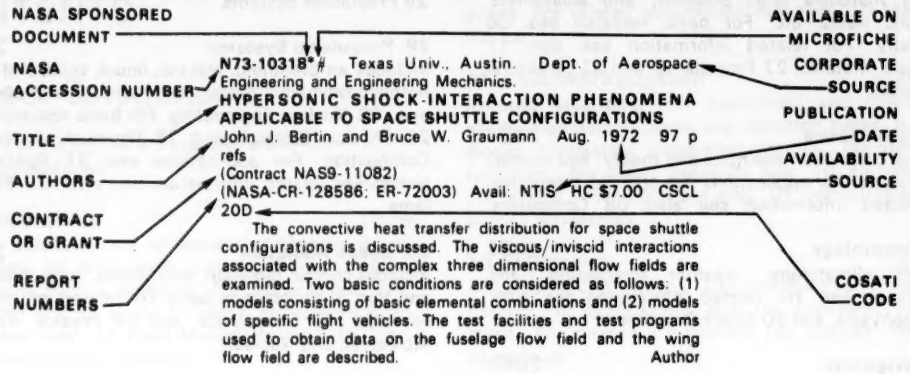
34 General 2098
Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

page

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-49
CORPORATE SOURCE INDEX I-55
CONTRACT NUMBER INDEX I-69
REPORT/ACCESSION NUMBER INDEX I-73

TYPICAL CITATIONS AND ABSTRACTS

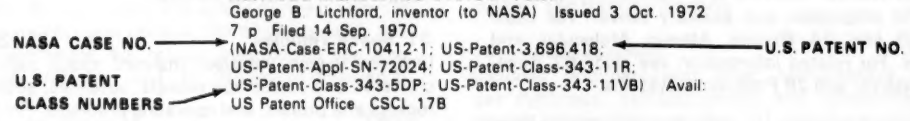
NASA CONTRACTOR REPORT CITATION AND ABSTRACT



N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D

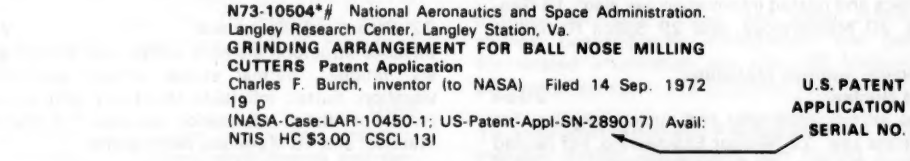
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

PATENT CITATION



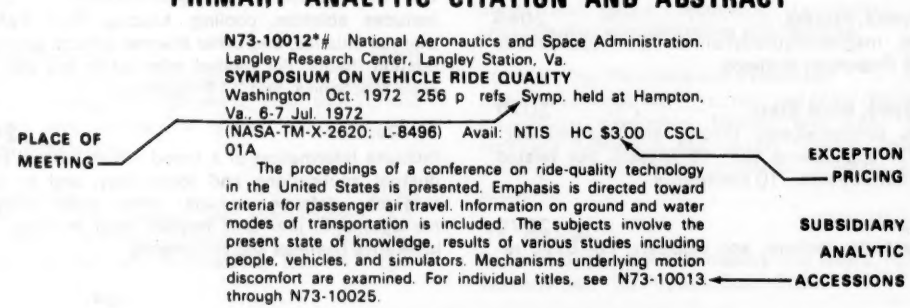
N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP; US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION



N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRANGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT



N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Leve, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02) CSCL 01A

Volume 11 Number 17 / September 8, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-25997*# California Inst. of Tech., Pasadena.
AN INVESTIGATION OF A TWO-DIMENSIONAL PROPULSIVE LIFTING SYSTEM
Carl A. Shollenberger Washington NASA May 1973 115 p refs
(Grant NGR-05-002-161)
(NASA-CR-2250) Avail: NTIS HC $3.00 CSCL 01A

Several aspects of the nonhomogeneous flow associated with a system combining lifting and propulsive requirements of an aircraft are considered by analytical and experimental methods. The basic geometry of the problem is that of two lifting surfaces with an actuator disk located between them. The principles governing flow with energy addition are examined. Basic equations and boundary conditions are developed for the complete inviscid and incompressible analysis for the two-dimensional case. The corresponding flow singularities are discussed and the integral equations which completely specify the system are derived. The two special cases of small and large energy addition are considered in detail including solutions. A numerical procedure is developed to solve the full problem including allowance for the wake deflection. Appropriate vorticity forms are used to represent the entire system. An iterative scheme is presented which rapidly converges to a solution for the magnitude and location of the system vorticity distributions. Forces and moments are evaluated on the propulsive lift system. Author

N73-25998*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC AERODYNAMIC CHARACTERISTICS OF A SPACE SHUTTLE ORBITER
James C. Ellison Washington Jul. 1973 26 p refs
(NASA-TM-X-2786; L-8765) Avail: NTIS HC $3.00 CSCL 22B

A space shuttle orbiter has been studied in a low turbulence pressure tunnel at a Mach number of 0.25 and Reynolds numbers from 4.17 x 1 million to 29. 17 x 1 million, based model length. The angle of attack range was about -4 to 24 deg at angles of sideslip of 0 and 5 deg. Static longitudinal and lateral directional aerodynamic characteristics were obtained for elevon deflections from 0 to -20 deg. The model was longitudinally stable at all test conditions; however, depending on Reynolds number and eleven deflection angle, the model was directionally unstable for angles of attack between 9 and 17 deg. The model had a maximum trimmed lift drag ratio of about 6.25 which occured at an angle of attack of about 9 deg with an elevon deflection of -10 deg. Author

N73-25999*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MANEUVER AND BUFFET CHARACTERISTICS OF FIGHTER AIRCRAFT
Edward J. Ray, Linwood W. McKinney, and Julian G. Carmichael (McDonnell Douglas Corp.) Washington Jul. 1973 18 p refs
(NASA-TN-D-7131; L-8554) Avail: NTIS HC $3.00 CSCL 01C

Recent research efforts in the improvement of the maneuverability of fighter aircraft in the high-subsonic and transonic speed range are reviewed with emphasis on the factors affecting aerodynamic boundaries, such as maximum obtainable lift, buffet onset, pitchup, wing rock, and nose slice. The investigations were made using a general research configuration which encompassed a systematic matrix of wing-design parameters. These results illustrated the sensitivity of section and planform geometry to a selected design point. The incorporation of variable-geometry wing devices in the form of flaps or leading-edge slats was shown to provide controlled flow over a wide range of flight conditions and substantial improvements in maneuver capabilities. Additional studies indicated that the blending of a highly swept maneuver strake with an efficient, moderately swept wing offers a promising approach for improving maneuver characteristics at high angles of attack without excessive penalties in structural weight. Author

N73-26000*# Kanner (Leo) Associates, Redwood City, Calif.
AIRFOIL PROFILES IN A CRITICAL REYNOLDS NUMBER REGION
K. Kraemer Washington NASA Jun. 1973 42 p refs Transl. into ENGLISH from Sonderdruck aus der Z. Forsch. auf dem Gebiete des Ingenieurwesens" (West Germany), v. 27, no. 2, 1961 p 33-46
(Contract NASw-2481)
(NASA-TT-F-14959) Avail: NTIS HC $4.25 CSCL 01A

On the basis of boundary layer observations of force measurements and pressure distributions on three Gottinger profiles 801, 803 and 804 at small Reynolds numbers in the range of 2 x 10,000 and 5 x 100,000, it is clear that the transition from the laminar to the turbulent form in the boundary layer flow exerts a considerable influence on the aerodynamic coefficients of airfoils. The experiments provide insight into what takes place at the point of transition and during the appearance of laminar separating streams. The meaning of the expression critical Reynolds number will be more precisely defined. Author

N73-26001*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A METHOD FOR CALCULATING AERODYNAMIC HEATING ON SOUNDING ROCKET TANGENT OGIVE NOSES
L. D. Wing [1972] 9 p refs
(NASA-TM-X-69896) Avail: NTIS HC $3.00 CSCL 01A

A method is presented for calculating the aerodynamic heating and shear stresses at the wall for tangent ogive noses that are slender enough to maintain an attached nose shock through that portion of flight during which heat transfer from the boundary layer to the wall is significant. The lower entropy of the attached nose shock combined with the inclusion of the streamwise pressure

gradient yields a reasonable estimate of the actual flow conditions. Both laminar and turbulent boundary layers are examined and an approximation of the effects of (up to) moderate angles-of-attack is included in the analysis. The analytical method has been programmed in FORTRAN 4 for an IBM 360/91 computer. Author

N73-26002# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A METHOD FOR OBTAINING AERODYNAMIC COEFFICIENTS FROM YAWSONDE AND RADAR DATA
R. H. Whyte and W. H. Mermagen Mar. 1973 29 p refs
(DA Proj. 1T0-61102-A-33D)
(AD-759482; BRL-MR-2280) Avail: NTIS CSCL 19/4

A numerical integration method for the reduction of yawsonde data from instrumented projectiles in free flight has been developed. Yawsonde data represent two-dimensional information (solar aspect angle and spin) while the actual motion is three-dimensional (pitch, yaw, and spin). The method obtains a best fit of the aerodynamic coefficients in the equations of motion using numerical integration. The coefficients are iteratively adjusted. Linear aerodynamic coefficients have been derived from the flight of an M549, 155mm rocket assisted projectile. (Author Modified Abstract) GRA

N73-26003# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF THE PRODUCTION OF MAGNUS FORCES ON A HIGH FINENESS RATIO BODY OF REVOLUTION M.S. Thesis
Timothy Robert Beard Mar. 1973 68 p refs
(AD-759987) Avail: NTIS CSCL 16/2

A high fineness ratio body of revolution with an ogive forebody shape was tested at varying angles of attack, Reynolds numbers, and spin rates to measure the Magnus forces developed. The experimental data were compared with previously derived theoretical equations for an open-ended cylinder of revolution to substantiate the theoretical work. Author (GRA)

N73-26971 National Aeronautical Establishment, Ottawa (Ontario). Low Speed Aerodynamics Lab.
OBSERVATIONS ON THE PROBLEM OF SUBSPAN OSCILLATION OF BUNDLED POWER CONDUCTORS
R. L. Wardlaw, K. R. Cooper, and R. H. Scanlan (Princeton Univ.) *In* Natl. Res. Council of Can. Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeronaut. Est. 31 Mar. 1973 p 1-20 refs Reprinted Presented at Intern. Symp. on Vibration Probl. in Ind., England, 10-12 Apr. 1973 (For availability see N73-26970 17-34)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-26004* National Academy of Sciences - National Research Council, Washington, D.C.
SUPPRESSION OF FLUTTER Patent
Eliahu Nissim, inventor (to NASA) Issued 22 May 1973 11 p Filed 25 Mar. 1971 Supersedes N72-21009 (10 - 12, p 1554) Sponsored by NASA
(NASA-Case-LAR-10682-1; US-Patent-3,734,432; US-Patent-Appl-SN-127915; US-Patent-Class-244-77G; US-Patent-Class-244-75A; US-Patent-Class-244-76C; US-Patent-Class-244-77F) Avail: US Patent Office CSCL 01B

An active aerodynamic control system to control flutter over a large range of oscillatory frequencies is described. The system is not affected by mass, stiffness, elastic axis, or center of gravity location of the system, mode of vibration, or Mach number. The system consists of one or more pairs of leading edge and trailing edge hinged or deformable control surfaces, each pair operated in concert by a stability augmentation system. Torsion and bending motions are sensed and converted by the stability augmentation system into leading and trailing edge control surface deflections which produce lift forces and pitching moments to suppress flutter. P.N.F.

N73-26005* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DUAL-FUSELAGE AIRCRAFT HAVING YAWABLE WING AND HORIZONTAL STABILIZER Patent
Robert T. Jones, inventor (to NASA) Issued 5 Jun. 1973 15 p Filed 9 Dec. 1971 Supersedes N72-21010 (10 - 12, p 1554)
(NASA-Case-ARC-10470-1; US-Patent-3,737,121; US-Patent-Appl-SN-206279; US-Patent-Class-244-13; US-Patent-Class-244-46; US-Patent-Class-244-55) Avail: US Patent Office CSCL 01B

An aircraft configuration consisting of a pair of fuselages parallel to each other and connected by a main wing and a horizontal stabilizer which pivot on the fuselages is described. The pivotal attachment allows the wing to be yawed relative to the fuselages for high speed flight while at the same time spreading the weight and volume distribution of the aircraft along the direction of flight. The main wing is curved upward at the tips to compensate for any roll tendencies caused by its yawed position. Official Gazette of the U.S. Patent Office

N73-26006* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LIFE RAFT STABILIZER Patent
Matthew I. Radnofsky, James H. Barnett, Jr., Floyd L. Harrison, and Ralph J. Marak, inventors (to NASA) Issued 5 Jun. 1973 4 p Filed 30 Nov. 1971 Supersedes N72-20016 (10 - 11, p 1420)
(NASA-Case-MSC-12393-1; US-Patent-3,736,607; US-Patent-Appl-SN-203405; US-Patent-Class-9-2A; US-Patent-Class-9-3; US-Patent-Class-9-11A; US-Patent-Class-114-122) Avail: US Patent Office CSCL 06G

An improved life raft stabilizer for reducing rocking and substantially precluding capsizing is discussed. The stabilizer may be removably attached to the raft and is defined by flexible side walls which extend a considerable depth downwardly to one another in the water. The side walls, in conjunction with the floor of the raft, form a ballast enclosure. A weight is placed in the bottom of the enclosure and water port means are provided in the walls. Placement of the stabilizer in the water allows the weighted bottom to sink, producing submerged deployment thereof and permitting water to enter the enclosure through the port means, thus forming a ballast for the raft.
Official Gazette of the U.S. Patent Office

N73-26007*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH LIFT AIRCRAFT Patent Application
Willard S. Blanchard, Jr. and Joseph L. Johnson, Jr., inventors (to NASA) Filed 5 Jun. 1973 15 p
(NASA-Case-LAR-11252-1; US-Patent-Appl-SN-367268) Avail: NTIS HC $3.00 CSCL 01C

An aerodynamically balanced aircraft configuration is discussed. The design reduces the effects of large nose-down pitching moments generated by the flap high-lift forces, the loss of trim lift during high-lift flight, and the yawing moments caused by the loss of an engine without the use of large horizontal and vertical tails. Drawings of the proposed configuration are provided. Detailed descriptions of the airframe and control surfaces are included. NASA

N73-26008*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
QUIET JET TRANSPORT AIRCRAFT Patent Application
Oran W. Nicks, Richard E. Kuhn, Joseph L. Johnson, Jr., Willard S. Blanchard, Jr., and Tom F. Bonner, Jr., inventors (to NASA) Filed 5 Jun. 1973 11 p
(NASA-Case-LAR-11087-1; US-Patent-Appl-SN-367267) Avail: NTIS HC $3.00 CSCL 01C

An aircraft configuration for reducing jet aircraft noise by

exhausting the engine gases over the upper surface of the wings is described. Diagrams of typical installations are provided. Advantages and disadvantages of the system are discussed.
P.N.F.

N73-26009# Royal Aircraft Establishment, Farnborough (England).
ON AN EXPRESSION FOR THE IDEAL WEIGHT OF SHELL-TYPE FUSELAGES
Guiseppe Gabrielle Dec. 1972 7 p ref
(RAE-Lib-Trans-1688; BR32894; PUBL-56) Avail: NTIS HC $3.00

An expression is derived for the ideal weight of fuselages having the form of a body of revolution with a straight axis, to which can be compared the forms adopted in modern aircraft, especially those for passenger transport. From this expression, which takes into consideration the strength-affecting loads and their distribution, together with cabin pressurization, a general formula is deduced to which the empirical formulas which give the actual weight of the fuselages, based on statistically determined data, can be conveniently reduced by adopting suitable coefficients.
Author

N73-26010# Royal Aircraft Establishment, Farnborough (England).
INVESTIGATIONS INTO THE LIFTING PROBLEM OF SLENDER WINGS IN SUPERSONIC FLOW
Arabindo Das and Hans-Holger Schroeder Dec. 1972 47 p refs Transl. into ENGLISH from Z. Flugwiss (West Germany), v. 19, no. 7, 1971 p 265-281
(RAE-Lib-Trans-1677; BR32901) Avail: NTIS HC $4.50

Linearized theories applicable to slender wings in supersonic flow are discussed. The results from the exact linear theory, the extended theory of slender bodies, and the theory of very slender bodies are compared. The following subjects are examined: (1) the nature of the transition from a subsonic to supersonic leading edge, (2) the magnitude of the suction force at the wing leasing edge, (3) the effects of viscosity on the wing flow, and (4) the nonlinear influences associated with increasing Mach number and increasing incidence.
Author

N73-26011# Royal Aircraft Establishment, Farnborough (England).
EFFECT OF SONIC BOOMS ON BUILDINGS: REPORT OF THE FINAL SYNTHESIS
A. Chaumette Jul. 1972 66 p refs Transl. into ENGLISH of Centre Sci. et Tech. du Batiment, Paris, Report, 1 Mar. 1971
(RAE-Lib-Trans-1633; BR32285) Avail: NTIS HC $5.50

A program to measure the effects of sonic booms on light building structures was conducted. The magnitude of the stresses imposed by sonic booms are compared with those caused by the environment, differential movement of materials, variations in the dimensions due to changes in temperature and humidity, and ground movements. The conditions under which the stresses are evaluated are described. Mathematical models are included to define the stresses developed.
Author

N73-26012# Royal Aircraft Establishment, Farnborough (England).
THE FATIQUE BEHAVIOUR OF AIRCRAFT STRUCTURES
W. Barrois Feb. 1973 61 p refs Transl. into ENGLISH from Rev. Franc. Mecan. (France), v. 38, 1971 p 41-65
(RAE-Lib-Trans-1678; BR34102) Avail: NTIS HC $5.25

After a review of the qualitative laws for the fatigue behavior of components in which notches are present (because of assembly requirements) and of components containing undetected cracks incurred during service, the overall problem of life prediction for service aircraft structures is discussed from a practical viewpoint. The basic reasons which make exact predictions impossible are emphasized. These lead to the use of the fail-safe concept for the design of the structure. It is also necessary to protect the quality of structures from the detail design stage right through to the service maintenance phase, keeping an eye on the true properties of the materials used, the effects of different fabrication techniques, quality control procedures and the inevitable material defects.
Author

N73-26013# Royal Aircraft Establishment, Farnborough (England).
DETERMINATION OF THE LIFE OF HELICOPTER STRUCTURAL MEMBERS
R. Prinz Jan. 1973 69 p refs Transl. into ENGLISH from West German Rept. DLR-Mitt-69-26, 1969
(RAE-Lib-Trans-1520; BR33563; DLR-Mitt-69-26) Avail: NTIS HC $5.50

Methods for determining the service life of helicopter structural members are presented. Calculated or measured stress-time functions are investigated, and analytical and experimental methods are indicated for their statistical evaluation. The use of a standard test load distribution for fatigue investigations on rotor blades is proposed, which is based on various load spectra. A number of possibilities for the fatigue test program are indicated and the necessity for statistical evaluation of the experimental results is explained.
Author

N73-26014*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF ROTOR DESIGN TIP SPEED ON NOISE OF A 1.21 PRESSURE RATIO MODEL FAN UNDER STATIC CONDITIONS
I. J. Loeffler, S. Lieblein, and N. O. Stockman 1973 21 p Proposed for presentation at 1973 Winter Ann. Meeting of the ASME, Detroit, 11-15 Nov. 1973
(NASA-TM-X-68243; E-7555) Avail: NTIS HC $3.25 CSCL 01C

Preliminary results are presented for a reverberant-field noise investigation of three fan stages designed for the same overall total pressure ratio of 1.21 at different rotor tip speeds (750, 900, and 1050 ft/sec). The stages were tested statically in a 15-inch-diameter model lift fan installed in a wing pod located in the test section of a wind tunnel. Although the fan stages produced essentially the same design pressure ratio, marked differences were observed in the variation of fan noise with fan operating speed. At design speed, the forward-radiated sound power level was approximately the same for the 750 ft/sec and 900 ft/sec stages. For the 1050 ft/sec stage, the design-speed forward-radiated power level was about 7 db higher due to the generation of multiple pure tone noise.
Author

N73-26015*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF FINITE DIFFERENCE TECHNIQUES TO NOISE PROPAGATION IN JET ENGINE DUCTS
Kenneth J. Baumeister 1973 23 p refs Proposed for presentation at Winter Ann. Meeting of the ASME, Detroit, 11-15 Nov. 1973
(NASA-TM-X-68261; E-7551) Avail: NTIS HC $3.25 CSCL 20A

A finite difference formulation is presented for wave propagation in a rectangular two-dimensional duct without steady flow. The difference technique, which should be useful in the study of acoustically treated inlet and exhausts ducts used in turbofan engines, can readily handle acoustical flow field complications such as axial variations in wall impedance and cross section area. In the numerical analysis, the continuous acoustic field is lumped into a series of grid points in which the pressure and velocity at each grid point are separated into real and imaginary terms. An example calculation is also presented for the sound attenuation in a two-dimensional straight soft-walled suppressor.
Author

N73-26016# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
AIRCRAFT ACCIDENT REPORT: NORTH CENTRAL AIRLINES, INCORPORATED, ALLISON CONVAIR 340/440 (CV-580), N90858 AND AIR WISCONSIN INCORPORATED, DHC-6, N4043B NEAR APPLETON, WISCONSIN, 29 JUNE 1972
25 Apr. 1973 33 p
(NTSB-AAR-73-9; SA-433) Avail: NTIS HC $3.75

The midair collision of a Convair 340 and a DHC-6 aircraft near Appleton, Wisconsin on 29 June 1972 is reported. All personnel aboard both aircraft were fatalities following the collision and subsequent impact with Lake Winnebago. The cause of the accident is considered to be failure of the flight crews to detect

the presence of other aircraft in time to take evasive action. Hazy atmospheric conditions existing at the time contributed to the detection problem. Author

N73-26017# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: DELTA AIR LINES, INCORPORATED, MCDONNELL DOUGLAS DC-9-14, N3305L, GREATER SOUTHWEST INTERNATIONAL AIRPORT, FORT WORTH, TEXAS, 30 MAY 1972
13 Mar. 1973 38 p
(NTSB-AAR-73-3; SA-432) Avail: NTIS HC $4.00

The crash of a DC-9 aircraft at Fort Worth, Texas airport on 30 May 1972 is reported. The crash occurred during an attempted go-around following a landing approach. The landing approach was normal, but the aircraft began oscillating after passing the runway threshold and finally struck the runway in an extreme right wing low attitude. It was determined that the cause of the accident was an encounter with a trailing vortex generated by a large jet aircraft which preceded the DC-9 to the runway. Author

N73-26018# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: MOHAWK AIRLINES, INCORPORATED, FAIRCHILD HILLER FH-227B, N7818M, ALBANY, NEW YORK, 3 MARCH 1972
11 Apr. 1973 70 p
(NTSB-AAR-73-8; SA-431) Avail: NTIS HC $5.50

An aircraft accident involving a Fairchild Hiller-227B aircraft which crashed near Albany County Airport, New York on 3 March 1972 is discussed. The flight was conducting an instrument landing approach when the crew reported trouble with the left propeller. The aircraft hit a house about three miles short of the airport. It was determined that the cause of the accident was the inability of the crew to feather the left propeller. Author

N73-26019# Federal Aviation Administration, Washington, D.C. Aviation Forecast Div.
TERMINAL AREA FORECAST, 1974-1984
Oct. 1972 387 p
Avail: NTIS $21.50

Forecasts for fiscal years 1974, 1975, 1976, and 1984 of the key measures of aviation activity at selected airports are presented. The total Terminal Area Forecast includes 1,201 airports which meet at least one of the following criteria: (1) existing tower airport, (2) candidate for a tower, (3) 50 or more based aircraft, (4) receives certificated route air carrier service, and (5) 20,000 or more general aviation itinerant operations. The forecasts are prepared to meet the needs of planning personnel in FAA offices and services with future traffic levels at these airports. The report is organized by FAA region and within each region by state. National and regional summaries are included in the introduction. The airports in each state are listed in the alphabetical order of the communities they serve. Location identifiers for all existing tower airports are shown in large bold-face type. All other known airport location identifiers are shown in standard typewriter style. Airports currently planned for new, first-time towers are identified by a planned commissioning date directly beneath their location identifier (76 airports). Author

N73-26020# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT, US CIVIL AVIATION. ISSUE NUMBER 3 OF 1972 ACCIDENTS
1 May 1973 479 p
(NTSB-BA-73-4) Avail: NTIS HC $26.00

Selected aircraft accident reports, in brief format, occurring in U.S. Civil Aviation operations during calendar year 1972 are presented. The 900 General Aviation and 29 Air Carrier Accidents contained in this publication represent a random selection. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light pilot certificate, injuries, and causal factors. Author

N73-26021*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SIMULATOR INVESTIGATION OF THE INFLUENCE OF ENGINE RESPONSE CHARACTERISTICS ON THE APPROACH AND LANDING FOR AN EXTERNALLY BLOWN FLAP AIRCRAFT. PART 1: DESCRIPTION OF THE SIMULATION AND DISCUSSION OF RESULTS
James A. Franklin and Robert W. Koenig May 1973 79 p refs
(NASA-TM-X-62265) Avail: NTIS HC $6.00 CSCL 01C

Investigation of the influence of engine response characteristics on approach and landing operations of a powered lift aircraft were carried out in a piloted ground-based simulator. The aircraft simulated was a four engine, externally-blown jet-flap configuration having an 80 pound wing loading and .56 thrust to weight ratio. Results indicate that for ideal operating conditions and minimal pilot reaction delay, substantial reductions in engine-out wave-off altitude increment and touchdown sink rate for engine-out landings can be achieved with the fast engine compared to the slow engine response. However, delays in pilot reaction of one to two seconds diminish the advantage of rapid thrust response. A need exists for some form of automatic cueing of the pilot or automatic engine control to enable the potential of rapid thrust response to be realized in improving safety in the event of an engine failure. Author

N73-26022*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A SIMULATOR INVESTIGATION OF THE INFLUENCE OF ENGINE RESPONSE CHARACTERISTICS ON THE APPROACH AND LANDING FOR AN EXTERNALLY BLOWN FLAP AIRCRAFT. PART 2: AERODYNAMIC MODEL
Donald L. Ciffone and Glenn H. Robinson May 1973 70 p
(NASA-TM-X-62265(2)) Avail: NTIS HC $5.50 CSCL 01C

An analysis of the influence of engine response characteristics on the approach and landing of an externally blown flap aircraft was conducted using flight simulator facilities. The configuration of the aerodynamic model is described. The aerodynamic characteristics as a function of angle of attack, thrust coefficient, and flap deflection are presented in tabular form and as graphs. Author

N73-26023*# McDonnell-Douglas Corp., Long Beach, Calif.
THE EFFECTS ON CRUISE DRAG OF INSTALLING LONG-DUCT REFAN-ENGINE NACELLES ON THE MCDONNELL DOUGLAS DC-8-50 AND -61
J. T. Callaghan, J. E. Donelson, and J. P. Morelli May 1973 40 p refs
(Contract NAS3-16814)
(NASA-CR-121218; MDC-J5947) Avail: NTIS HC $4.00 CSCL 01C

A high-speed wind tunnel test was conducted to determine the effect on cruise performance of installing long-duct refan-engine nacelles on the DC-8-50 and -61 models. Drag data and wing/pylon/nacelle channel pressure data are presented. At a typical cruise condition there exists a very small interference drag penalty of less than one-percent of total cruise data for the Refan installation. Pressure data indicate that some supersonic flow is present in the inboard channel of the inboard refan nacelle installation, but it is not sufficient to cause any wave drag on boundary layer separation. One pylon modification, which takes the form of pylon bumps, was tested. It resulted in a drag penalty, because its design goal of eliminating shock-related interference drag was not required and the bump thus became a source of additional parasite drag. Author

N73-26024*# McDonnell-Douglas Corp., Long Beach, Calif.
THE EFFECTS ON CRUISE DRAG OF INSTALLING REFAN-ENGINE NACELLES ON THE MCDONNELL-DOUGLAS DC-9
J. T. Callaghan May 1973 41 p refs
(Contract NAS3-16814)
(NASA-CR-121219; MDC-J5948) Avail: NTIS HC $4.25 CSCL 01C

A high speed wind tunnel test has been conducted to determine the effect on cruise drag for installing larger JT8D Refan engine nacelles on the Douglas DC-9. Drag data and wing- and nacelle/pylon/fuselage-channel pressure data are

presented. Reduced pylon spares, required to minimize effects of the nacelle installation on low-speed deep stall, were investigated. The reduce span pylons resulted in no adverse interference effects. At typical cruise Mach numbers the measured penalty for the Refan installation was less than estimated due to a favorable effect of the larger entering engine stream tube suppressing the wing upper-surface velocities with subsequent wing compressibility drag reduction. Channel pressures show no shock waves or boundary layer separations. Author

N73-26025# Battelle Columbus Labs., Ohio.
A PROGRAM DEFINITION STUDY FOR THE IMPROVEMENT OF SHORT HAUL AIR TRANSPORTATION. VOLUME 1: RECOMMENDED PROGRAM PLAN Final Report
Jan. 1973 154 p refs
(Contract DOT-FA72WA-2820)
(FAA-QS-73-1-Vol-1) Avail: NTIS HC $9.75

A recommended program plan for Federal-initiative in the Government's continued pursuit of an improved short-haul air transportation system is presented. The plan was developed in response to the broad program requirements set forth in the contract statement of work and, more specifically, was based on the system development needs, opportunities, and constraints identified in the course of performing the study. It provides the responsible Government departments and agencies with a resource they can use in the formulation and adoption of an official plan for short-haul air transportation development.
Author

N73-26026# Urban Systems Research and Engineering, Inc., Cambridge, Mass.
A PLAN FOR THE IMPROVEMENT OF SHORT-HAUL AIR TRANSPORTATION Final Report
Mar. 1973 251 p
(Contract DOT-FA72WA-2816)
(FAA-QS-73-2) Avail: NTIS HC $14.75

A plan for fostering the improvement and development of the national short haul air transportation system through the year 1976 is developed. In addition, promising areas for short haul improvement are identified for the period 1972 through 1990. The plan and recommendations are based on a computer simulation comparison of alternative short haul concepts which include various combinations of vehicle types and airport configurations. Measures such as air travel demand, operating costs, revenues, noise impact, and congestion relief are utilized in making these comparisons. Author

N73-26027# Aeronautical Research Associates of Princeton, Inc., N.J.
CALCULATION OF THE WAKES OF THREE TRANSPORT AIRCRAFT IN HOLDING, TAKEOFF, AND LANDING CONFIGURATIONS AND COMPARISON WITH EXPERIMENTAL MEASUREMENTS Final Report
Coleman duPDonaldson, Richard S. Snedeker, and Roger D. Sullivan Mar. 1973 110 p refs
(Contracts DOT-FA72WAI-309; F44620-69-C-0089)
(FAA-RD-73-42; ARAP-190) Avail: NTIS HC $7.50

A method is described for the calculation of the initial form and location of the inviscid rolled-up wake vortices behind wings having both simple and complex load distributions such as those which occur when the wing is highly flapped. The method makes use of the Betz theorems of conservation of vorticity and moments of vorticity in the wake. It is found that a simple relationship exists between the radial distribution of vorticity concentrated in the wake vortices and the spanwise distribution of vorticity shed from the wing. Velocity profiles computed for the wake vortices of several aircraft in holding, takeoff, and landing configurations are shown to compare favorably with those measured at times up to one minute after fly-by during full scale experiments.
Author

N73-26028# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORTS, BRIEF FORMAT, SUPPLEMENTAL ISSUE, 1971 ACCIDENTS
4 May 1973 103 p
(NTSB-BA-73-5) Avail: NTIS HC $7.25

Reports of aircraft accidents and incidents that occurred in 1971 and have not been included in a prior issue of briefs are presented. Included are 11 U.S. Air Carrier accidents, 53 U.S. Air Carrier indicents, 14 U.S. General Aviation accidents, and 57 U.S. General Aviation incidents. One Foreign Air Carrier accident, and 16 Foreign General Aviation accidents that were investigated by the National Transportation Safety Board are also included. This publication is the final issue of Briefs of Accidents that occurred in calendar year 1971. Author

N73-26029# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT, NORTHWEST AIRLINES, INCORPORATED, BOEING 747-151, N602US, MIAMI, FLORIDA
30 May 1973 13 p
(NTSB-AAR-73-12) Avail: NTIS HC $3.00

The aircraft accident involving a Boeing 747 aircraft which ran off the end of the runway during landing at Miami, Florida airport on 15 Dec. 1972 is reported. The aircraft had collided with a flock of gulls during takeoff and number four engine was shut down. The aircraft was cleared to return to the airport. The cause of the accident was due to ineffective braking capability of the aircraft on the wet runway and lack of reverse thrust due to shut down of number four engine and malfunction of thrust reverser on number three engine. Author

N73-26030*# Linguistic Systems, Inc., Cambridge, Mass.
NOISE CHARACTERISTICS OF A JET AUGMENTED FLAP CONFIGURATION
Alain Burrand Washington NASA Jun. 1973 20 p refs Transl. into ENGLISH from l'Aeronautique et l'Astronautique (France), no. 39, 1973 p 44-54 Presented at the 3rd Colloq. on Aeronautic Acoustics, Toulouse, 6-7 Mar. 1972
(Contract NASw-2482)
(NASA-TT-F-14951) Avail: NTIS HC $3.00 CSCL 23A

The STOL-type aircraft lift augmenting requires the use of very efficient devices which, however, are likely to be sources of noise themselves or may modify the noise generated by the jet-engines. Among these devices is the internal-flow jet augmented flap wherein a jet from auxiliary generators is directed onto the wing flap upper-surface. The noise of this device is to be added to that produced by the engines. Static tests recently performed in an anechoic chamber have made it possible to investigate the various possible configurations and to appraise the effect of numerous parameters. The application of results at full scale allows the noise level of this STOL type to be evaluated. Author

N73-26031*# Scientific Translation Service, Santa Barbara, Calif.
SLENDER DELTA WINGS FOR FUTURE SUBSONIC COMMERCIAL AIRCRAFT
Martin Lichte Washington NASA Jun. 1973 28 p Transl. into ENGLISH from Flug Rev. (West Germany), no. 2, 1973 p 27-37
(Contract NASw-2483)
(NASA-TT-F-14949) Avail: NTIS HC $3.50 CSCL 01C

The aerodynamic characteristics of slender delta wings for subsonic commercial aircraft applications are discussed. The flow distribution on the wing for various airspeed conditions is described. The characteristics of conventional wings are compared with those of the slender delta wing. Graphs of the performance of the slender delta wing for various conditions of ground effect, angle of attack, glide conditions, and aerodynamic stall are included. Author

N73-26032# Boeing Co., Seattle, Wash. Customer Support Dept.
COMMERCIAL JET MAINTENANCE AND RELIABILITY ADVANCEMENTS
R. T. Dixon Nov. 1972 29 p Presented at FAA 8th ANN. Intern Maintenance Symp., 28-30 Nov. 1972
Avail: NTIS HC $3.50

A review of the progress made in the pre-World War 2 and post-World War 2 periods with respect to the commercial aviation industry is presented. The techniques that have been developed for use during the design of an aircraft to achieve high reliability and low maintenance cost are discussed. A summary of the

latest methods that have been developed for instituting aircraft maintenance programs and the actions taken to achieve maximum efficiency and lowest maintenance costs is reported. Author

N73-26033# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Flugmechanik der Luftfahrzeuge.

DETERMINATION OF THE DERIVATIVES OF LONGITUDINAL MOTION OF AN AIRCRAFT FROM FLIGHT DATA BY A MODEL WITH AUTOMATIC PARAMETER ADJUSTMENT

Ruthard Koehler 5 Dec. 1972 35 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-13) Avail: NTIS HC $3.75; DFVLR, Porz: 10 DM

A circuit for determining the derivatives of an aircraft from flight data and which needs relatively few computation elements at the analog computer is discussed. Since quadratic terms are also taken into account in the analysis, the polar can be determined from the ascertained coefficients in the environment of a point. The results of an evaluation of flight data are discussed.

Author (ESRO)

N73-26034# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Flugbahnen.

INVESTIGATION AND APPLICATION OF TWO METHODS FOR DETERMINING TRANSFER-FUNCTION COEFFICIENTS OF THE LONGITUDINAL MOTION OF AIRCRAFT FROM MEASURED INPUT AND OUTPUT DATA

Werner Boegel 31 Jan. 1973 81 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-39) Avail: NTIS HC $6.25; DFVLR, Porz, West Ger. 17,30 DM

The basis and operation of two methods for determining transfer function coefficients are briefly described. The first may be classified as an equations of motion method and the second as a response curve fitting method. Variations of the former method are presented for special cases. A description of the digital computer programs is given. The methods were investigated using these programs and digitally simulated input-output data. The computed results provide information describing the propagation of random and non-random errors. This information aided in the design of the input function. It also facilitated the choice of methods for executing flight tests and for the reduction and evaluation of flight test data. The application of these methods to flight data is demonstrated using measurements of the short period longitudinal motion of the Piaggio P 149 D aircraft.

Author (ESRO)

N73-26035# Elliott-Automation Space and Advanced Military Systems, Ltd., Camberley (England).

A STUDY TO DEFINE AN EXPERIMENTAL AIRCRAFT FOR EARTH RESOURCE SURVEYS. VOLUME 1: SUMMARY Final Report

Jul. 1972 97 p Prepared jointly with Fairey Surveys

(Contract ESTEC-1516/71-EL)

(ESRO-CR(P)-128) Avail: NTIS HC $7.00

The results of a study of a proposed Earth Resources Aircraft Facility (ERAF) to develop a European capability in the remote sensing of earth resources are presented. The objectives are first discussed followed by a description of missions and sensors. The reasons leading to the selection of the Fokker F-27 are given together with a description of the aircraft. The support facilities are noted and ownership and organization discussed. The program for aircraft procurement, conversion and testing is outlined along with the program of operations. Finally, costs and potential problem areas are defined. ESRO

N73-26036# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT, MACHINERY BUYERS CORPORATION, LEARJET MODEL 24, N454RN, ATLANTA, GEORGIA, 26 FEBRUARY 1973

30 May 1973 14 p

(NTSB-AAR-73-12) Avail: NTIS HC $3.00

The crash of a Learjet Model 24 following takeoff from the Atlanta, Georgia airport on 26 Feb. 1973 is reported. The cause of the accident is the loss of engine thrust during takeoff due to ingestion of birds and subsequent loss of control of the aircraft. Author

N73-26037# Rochester Applied Science Associates, Inc., N.Y.

DEVELOPMENT OF A TECHNIQUE FOR REALISTIC PREDICTION AND ELECTRONIC SYNTHESIS OF HELICOPTER ROTOR NOISE Final Report

H. Kevin Johnson Mar. 1973 133 p refs

(Contract DAAJ02-71-C-0064; DA Proj. 1F1-62208-AA-82)

(AD-759955; RASA-72-08; USAAMRDL-TR-73-8) Avail: NTIS CSCL 01/3

A helicopter rotor noise prediction program was developed so that the acoustic characteristics of new, untested rotor designs could be evaluated as well as the effects of basic rotor design changes on the acoustic signature of existing rotors. The prediction program is general enough to be able to consider future designs in hover and steady state flight for any observer location. The program output is the digital pressure time history produced by the helicopter rotors at the observer location. This pressure time history corresponds to that which would be recorded by a microphone place at the observer location. The program output can be Fourier analyzed so that the noise spectrum can be generated. The digital pressure time history can also be converted to an analog signal for subjective evaluation.

Author (GRA)

N73-26038# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.

FIELD-REPLACEABLE ROTOR BLADE POCKET STUDY Final Report

Pierce A. Meck and Charles V. Galli Feb. 1973 135 p refs

(Contract DAAJ02-71-C-0022; DA Proj. 1F1-63204-DB-38)

(AD-759956; SER-50758; USAAMRDL-TR-72-69) Avail: NTIS CSCL 01/3

The present CH-54B blade consists of 28 nonstructural pockets of 14 different configurations because of spar taper. When damaged, these pockets have had to be replaced at Sikorsky because of the present heat-curing adhesive utilized for pocket attachment. The purpose of this program was to design, fabricate, and test a field-replaceable pocket which could be utilized in any position along the blade spar and attached with ambient-temperature curing adhesives at field level to reduce cost and eliminate shipping time to CONUS. The program was conducted in three phases. Phase I consisted of design, fabrication, and test of a practical universal pocket. Phase II consisted of adhesive selection and qualification testing plus the design and fabrication of a field jigging kit. Phase III consisted of a comparison of the cost of repairing CH-54 main blades using factory support and by field-replaceable pocket kits. The study showed that the pocket design was universally adaptable to any of 27 positions on the blade and was structurally and aerodynamically adequate. The adhesive selected provided acceptable bond strength under simulated field conditions, and the field pocket jigging fixture was lightweight and capable of being utilized by Army aircraft maintenance personnel. The study showed that field repair with the universal pocket would result in a rotor blade life-cycle savings of about $300,000 per year. Author (GRA)

N73-26039# Army Electronics Command, Fort Monmouth, N.J.

OPTIMAL DESIGN OF HELICOPTER PRECISION HOVER CONTROL SYSTEMS

N. N. Purl and R. J. Niemela Apr. 1973 36 p refs

(DA Proj. 1F1-62202-A-97)

(AD-759919; ECOM-4109) Avail: NTIS CSCL 01/2

Modern Control Theory is employed to analytically determine the limit of positional precision with which a helicopter can be hovered. Approaches based on Liapunov's Second Method and a Squared Root Locus Method are formulated to this optimal control problem. Both of these methods avoid iterative solution of the Matrix Riccati Equation. The Squared Root Locus Method is developed as a computer algorithm which generates optimal control designs as a function of performance index and helicopter stability/control derivatives. Practical design constraints can readily be interpreted from the results of this formulation.

Author (GRA)

N73-26040# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
LANDING APPROACH AUTOMATIC FLIGHT CONTROL SYSTEM DESIGN VIA REDUCED ORDER OPTIMAL CONTROL LAW M.S. Thesis
Jerry DeVerne Pfleeger Jun. 1973 89 p refs
(AD-760125; GGC/MA/73-3) Avail: NTIS CSCL 01/3

A set of optimal feedback gains is used as a basis for designing a practical longitudinal automatic flight control system for the landing approach task. A procedure is developed to give a good first-cut design. The procedure is systematic and straightforward. The procedure is used to design two control systems for a DC-8 aircraft. In one case it is assumed that pitch, rate, normal acceleration, and longitudinal airspeed are continuously measured on board the aircraft. The second system is similar to the first with the exception that longitudinal airspeed is deleted as one of the measured variables. These systems are compared with a high-performance automatic flight control system that was designed using classical control techniques. The procedure is also used to design two control systems for a hypothetical aircraft with direct lift control capability.
Author (GRA)

N73-26041# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT FROM 1 JANUARY 1962 TO 1 JANUARY 1973 Semiannual Summary Report
Thomas A. DeFiore 1 May 1973 38 p refs
(AD-760321; NADC-13920-2) Avail: NTIS CSCL 01/3

The report is a specialized summary of normal acceleration data recorded by counting accelerometers. Data are separated by calendar time and mission category. Only data reported in the counting accelerometer program are included. Author (GRA)

N73-26042# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
EQUIVALENCE RULE AND TRANSONIC FLOWS INVOLVING LIFT
H. K. Cheng and Mohamed M. Hafez Apr. 1973 36 p refs
(Contract N00014-67-A-0269-0021; NR Proj. 061-192)
(AD-760349; USCAE-124) Avail: NTIS CSCL 01/3

The transonic flow around a thin and smooth configuration with swept leading edge is shown to possess an outer nonlinear structure determined principally by an equivalent line source and an equivalent line doublet. In the lift dominated and intermediate domains there is an important nonlinear lift contribution to the equivalent source, which depends on both the axial and the spanwise lift distributions. This lift contribution is not completely accounted for by the transonic small-disturbance equation. Parametric estimates based on existing transonic transport proposals indicate significant lift effect on the nonlinear outer flow. Relaxation methods based on second-order difference schemes are developed to solve the reduced lift problem in the thickness-controlled domain. (Author Modified Abstract) GRA

N73-26043# Boeing Vertol Co., Philadelphia, Pa.
EQUIVALENT ROUTE WINDS FOR HELICOPTER AIR ROUTES AT HEIGHTS OF 5,000, 10,000 AND 18,000 FEET, VOLUME 1
D. G. Brown, R. J. Cooper, and R. D. Spragg Apr. 1973 321 p refs 2 Vol.
(AD-760252; D210-10600-1-Vol-1) Avail: NTIS CSCL 01/2

Equivalent headwinds or equivalent winds are computed using Sawyer's method for approximately 4400 strategic world air routes contained in Volumes 1 and 2. The seasonal mean equivalent wind and its standard deviation and the annual 50-, 75-, and 85-percent reliability equivalent winds are tabulated. Route winds are computed for the 5,000, 10,000, and 18,000 foot levels. An IBM 360/65 program was used to compute the equivalent winds. Input data for the program consist, for each level, of a grid composed of the mean vector wind and the standard vector deviation at the intersection of each 5 degrees of latitude with each 10 degrees of longitude between 60 degrees S and 60 degrees N and at the intersection of each 5 degrees of latitude and each 20 degrees of longitude south and north of 60 degrees S and 60 degrees N respectively. In addition to the equivalent winds, great circle distances are computed and tabulated for each route. Author (GRA)

N73-26044# Boeing Vertol Co., Philadelphia, Pa.
EQUIVALENT ROUTE WINDS FOR HELICOPTER AIR ROUTES AT HEIGHTS OF 5,000, 10,000 AND 18,000 FEET, VOLUME 2
D. G. Brown, R. J. Cooper, and R. D. Spragg Apr. 1973 260 p refs 2 Vol.
(AD-760253; D210-10600-2-Vol-2) Avail: NTIS CSCL 01/2

Equivalent headwinds or equivalent winds are computed using Sawyer's method for approximately 4400 strategic world air routes contained in Volumes I and II. The seasonal mean equivalent wind and its standard deviation and the annual 50-, 75-, and 85-percent reliability equivalent winds are tabulated. Route winds are computed for the 5,000, 10,000, and 18,000 foot levels. (Author Modified Abstract) GRA

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-26045*# Computer Sciences Corp., Falls Church, Va.
FUEL CELLS: A SURVEY
Bernard J. Crowe Washington NASA 1973 112 p refs
(Contract NASw-2173)
(NASA-SP-5115; LC-72-600266) Avail: NTIS MF $1.45; SOD HC $0.85 Domestic Postpaid or $0.60 GPO Bookstore CSCL 10A

A survey of fuel cell technology and applications is presented. The operating principles, performance capabilities, and limitations of fuel cells are discussed. Diagrams of fuel cell construction and operating characteristics are provided. Photographs of typical installations are included. Author

N73-26046*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation and Engineering Lab.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS Annual Report on Cycle Life Test
D. E. Christy and J. D. Harkness 22 May 1973 268 p refs
(NASA Order S-23404-G)
(NASA-CR-133088; QEEL/C-73-4; AR-9) Avail: NTIS HC $15.50 CSCL 10C

A life cycle test of secondary electric batteries for spacecraft applications was conducted. A sample number of nickel cadmium batteries were subjected to general performance tests to determine the limit of their actual capabilities. Weaknesses discovered in cell design are reported and aid in research and development efforts toward improving the reliability of spacecraft batteries. A statistical analysis of the life cycle prediction and cause of failure versus test conditions is provided. Author

N73-26047*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRADED BANDGAP Al(x)Ga(1-x)A s-GaAs SOLAR CELL Patent Application
James A. Hutchby, inventor (to NASA) Filed 21 Jun. 1973 14 p
(NASA-Case-LAR-11174-1; US-Patent-Appl-SN-372142) Avail: NTIS HC $3.00 CSCL 10A

A p-type GaAs crystal adjoining an n-type Ga(l-x)Al(x)As crystal to form a p-n junction is reported. The value of x varies linearly in the n-type crystal from x = O at the junction of the two crystals to x = .7 at the opposite surface of the n-type crystal. Hence, when the opposite surface of the n-type crystal is exposed to solar radiation, energy is delivered by the p-n junction more efficiently than it is delivered by prior p-n junction type solar cells. NASA

N73-26048*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COVERED SILICON SOLAR CELLS Patent Application

J. D. Broder, inventor (to NASA) Filed 18 Jun. 1973 8 p
(NASA-Case-LEW-11065-2; US-Patent-Appl-SN-371322) Avail: NTIS HC $3.00 CSCL 10A

An improved silicon solar cell is reported that has a transparent plastic film of fluorinated ethylene propylene copolymer for a binding agent to attach a cover glass. NASA

N73-26049# Royal Aircraft Establishment, Farnborough (England).
OPERATION OF THE ALTERNATOR UNDER CONDITIONS OF RECTIFIED OUTPUT
F. Lucas Feb. 1973 31 p refs Transl. into ENGLISH from Rev. Gen. Elec. (France), v. 80, no. 12, 1971 p 898-908
(RAE-Lib-Trans-1679; BR33562) Avail: NTIS HC $3.75

The utilization of a rectifier bridge and alternator to show the operation of an alternator feeding into a direct current system through a rectifying device is discussed. There are two conditions of operation: (1) synchronous operation and (2) operation under harmonic conditions. A method of forecasting the operation of an alternator under conditions of rectified output is presented. An experimental analysis of the method is included. Author

N73-26050*# Pratt and Whitney Aircraft, South Windsor, Conn.
DEVELOPMENT OF ADVANCED FUEL CELL SYSTEM Final Report
P. E. Grevstad Nov. 1972 222 p
(Contract NAS3-15339)
(NASA-CR-121136; PWA-4542) Avail: NTIS HC $13.25 CSCL 10A

Weight, life and performance characteristics optimization of hydrogen-oxygen fuel cell power systems were considered. A promising gold alloy cathode catalyst was identified and tested in a cell for 5,000 hours. The compatibility characteristics of candidate polymer structural materials were measured after exposure to electrolyte and water vapor for 8,000 hours. Lightweight cell designs were prepared and fabrication techniques to produce them were developed. Testing demonstrated that predicted performance was achieved. Lightweight components for passive product water removal and evaporative cooling of cells were demonstrated. Systems studies identified fuel cell powerplant concepts for meeting the requirements of advanced spacecraft. Author

N73-26051# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMOELECTRIC BATTERIES OF INCREASED EFFECTIVENESS
N. S. Lidorenko, V. F. Lebedev, and V. A. Simonov 3 Apr. 1973 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. Transp. (Moscow), no. 4, 1972 p 117-122
(AD-759239; FTD-MT-24-76-73) Avail: NTIS CSCL 10/2

The advantages of tube batteries intended for use in thermoelectric air conditioners are analyzed. The factors determined during the development of rational designs of such batteries are examined. An analytical study was made of the temperature fields of a half-cell and heat conductor, which is simultaneously also a current conductor, for the particular conditions of their operation. The corresponding dependences are obtained, including an expression for determining the distribution of temperature in the junction between the half-cell and the heat conductor. Author (GRA)

N73-26052# Heliotek, Sylmar, Calif.
VERTICAL MULTIJUNCTION SOLAR CELLS Final Technical Report, 15 Nov. 1971 - 15 Dec. 1972
Paul M. Stella Feb. 1973 136 p refs
(Contract F33615-72-C-1310; AF Proj. 3145)
(AD-760172; Rept-380-4654; AFAPL-TR-73-3) Avail: NTIS CSCL 10/2

A theoretical analysis of the vertical multijunction (VMJ) solar cell was performed which indicated that using silicon certain configurations could be fabricated to satisfy the program objectives. Results indicate that initial AMO efficiencies of 15% can be achieved, and that at least 12% efficiency can be expected after seven years operation at synchronous orbit in a nuclear weapons environment. Experimental devices fabricated during the program exhibited relatively high long wavelength response as predicted by theory. These oversize devices (widths approximately 100 micrometers) exhibited low efficiencies (6-8%) and poor short wavelength response due to slow surface states which drastically reduced short wavelength collection efficiency and device voltage as well as causing instability in the device I-V characteristic. These surface states must be eliminated if high efficiency VMJ devices are to become a reality. (Author Modified Abstract) GRA

N73-26053# Yardney Electric Corp., Pawcatuck, Conn.
WATER ACTIVATED ZINC-AIR STANDARD LINE BATTERY BA-535/PRC-70 Final Report, Oct. 1969 - Nov. 1972
Sandy Seidman Mar. 1973 68 p refs
(Contract DAAB07-70-C-0057; DA Proj. 1T6-62705-A-053)
(AD-759932; ECOM-0057-F) Avail: NTIS CSCL 10/3

The report describes the design, development, and fabrication of the BA-535/PRC-70 battery which is adaptable for use as either a 12.0 or a 24.0 volt system. The unit has a rated capacity of 20 ampere hours at 24 volts and 40 ampere hours when discharged at 12.0 volts. The batteries make use of the bi-cell (dual cathode) system and are designed to be activated by the addition of water. Since the BA-535/PRC-70 is a primary system, it is to be used once and then discarded. Although the battery was primarily designed for use with the PRC-70 Field Radio System, it has been tested at other operating regimes. (Author Modified Abstract) GRA

N73-26054# Magnetic Corp. of America, Waltham, Mass.
DEVELOPMENT OF PULSED HIGH ENERGY INDUCTIVE ENERGY STORAGE SYSTEMS. VOLUME 3: WEIGHT OPTIMIZATION FOR ENERGY STORAGE, COIL, CRYOGEN AND DEWAR Technical Report, Apr. 1971 - Apr. 1972
Edward J. Lucas, William F. B. Punchard, and Richard J. Thome Wright-Patterson AFB, Ohio AFAPL Dec. 1972 109 p
(Contract F33615-71-C-1454; AF Proj. 3145)
(AD-755360; AFAPL-TR-72-38-Vol-3) Avail: NTIS CSCL 10/2

The report provides weight estimates for possible configurations which may be used in one of these subsystems, that which is devoted to energy storage. For the purposes of this study, it will be assumed that the energy storage subsystem consists of three components: (1) the cryogenic coils, (2) the cryogen and (3) the dewar. The limits of the subsystem are the electrical terminals entering and leaving the dewar. All other components are assumed to be located in other subsystems. The method of determining the weights of the components of the subsystem will be discussed, followed by a discussion of the manner in which subsystems were optimized. The section closes with tables giving characteristics of weight optimized systems for a range of energy, pulse length, total pulses, wire diameter, and copper to superconductor ratio. GRA

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-26055*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 114, APRIL 1973
Apr. 1973 98 p refs
(NASA-SP-7011(114)) Avail: NTIS HC $3.00 CSCL 06E

This special bibliography lists 342 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1973. Author

N73-26056*# Public Health Service Hospital, San Francisco, Calif. Dept. of Medicine.
A STUDY OF VENTRICULAR CONTRACTILITY AND OTHER PARAMETERS POSSIBLY RELATED TO VASODEPRESSOR SYNCOPE
Kenneth H. Hyatt, Robert W. Sullivan, William R. Spears, and William R. Vetter May 1973 89 p refs

(NASA Order T-81035)
(NASA-CR-128968) Avail: NTIS HC $6.50 CSCL 06P

The effects of diminished orthostatic and exercise tolerance resulting from prolonged bedrest were studied by noninvasion methods to determine if alterations in myocardial contractility were induced by bedrest. These methods were apexcardiography, systolic time intervals, and echocardiography. It is concluded that bedrest causes detrimental alterations in the contractile state of the myocardium which accounts for the decreases in maximal oxygen uptaken during exercise after bedrest. Tabulated test data are included. F.O.S.

N73-26057# Civil Aeromedical Inst., Oklahoma City, Okla.
SIMULATED SONIC BOOMS AND SLEEP: EFFECTS OF REPEATED BOOMS OF 1.0 PSF
William E. Collins and P. F. Iampietro Dec. 1972 30 p refs
(FAA-AM-72-35) Avail: NTIS HC $3.50

The effects of repeated simulated sonic booms on sleeping male subjects were investigated. The techniques for conducting the tests are described. No statistically significant effect of the boom presentations on nightly sleep patterns was observed. It was noted that individual booms aroused ECG, EMG, and BSR responses in all eight subjects. Author

N73-26058*# Food and Drug Administration, Cincinnati, Ohio. Food Research Lab.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Oct. - 31 Dec. 1972
J. E. Campbell et al Mar. 1973 6 p
(Contract NASA Order W-13411)
(NASA-CR-133223; QPR-31) Avail: NTIS HC $3.00 CSCL 06M

The thermal inactivation curve for Bacillus subtilis var. niger spores on the Viking lander is examined. Tests were conducted at 113 C and 25% RH, and over a wide range of temperatures using < .001% RH and additions of P2O5 to dry the environment. Results show the 25% RH environment did not significantly reduce the survival curve, while the survival curves for spores treated under the drier .001% RH environment was reduced by a factor of 3. E.H.W.

N73-26059*# Food and Drug Administration, Cincinnati, Ohio. Food Research Labs.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Jan. - 31 Mar. 1973
J. E. Campbell Jun. 1973 9 p
(Contract NASA Order W-13411)
(NASA-CR-133224; QPR-32) Avail: NTIS HC $3.00 CSCL 06M

Studies were made of atypical organisms found in Bacillus subtilis var. niger spore colonies. Efforts were aimed at: (1) determining the heat sensitivity of these atypical white spores treated under dry heat conditions and their influence on the nature of the survival curve, (2) preparing a new spore crop obtained from spore isolates by purification procedures, and (3) comparing spore crops obtained from Cape Kennedy (SSM-10) and Minnesota (Minn. sp. AAEF) with the old Cincinnati and new purified Cincinnati spore crop under dry heat conditions. Author

N73-26060# Royal Aircraft Establishment, Farnborough (England).
OXYGEN DIFFUSION IN THE BRAIN. PART 1: SPATIAL CONCEPTION AND CALCULATION OF OXYGEN DIFFUSION
K. Diemer Oct. 1972 14 p ref Transl. into ENGLISH from Pflugers Arch. (West Germany), v. 285, 1965 p 99-108
(RAE-Lib-Trans-1663; BR32232) Avail: NTIS HC $3.00

A new model of oxygen diffusion in the brain is developed, based on anatomical investigations and theoretical considerations. In this cone model it is assumed that the diffusion path is determined by the difference between the pO sub 2 at a given point in the capillary and the minimum tissue pO sub 2; a larger region is supplied by the arterial end of the capillary with its higher pO sub 2 than by its venous end. The limit of the region of tissue supplied by a capillary is formed by the isobar of the minimum tissue pO sub 2, the path of which is variable and dependent on various factors. It is fundamentally conceivable that oxygen also diffuses into the tissue from the venous end of the capillary, i.e. that the volume supplied by a capillary becomes a truncated cone. For normal conditions however it is quite likely that the mean intercapillary distance is largely identical with the diffusion path of oxygen from the arterial end of the capillary, while practically no oxygen diffuses into the tissue from the venous end of the capillary. Author

N73-26061# Royal Aircraft Establishment, Farnborough (England).
THE RAPID DETERMINATION OF ALDOSTERONE IN URINE BY PAPER CHROMATOGRAPHY
Laszlo Debreceni and Bela Csete Dec. 1972 11 p refs Transl. into ENGLISH from Orv. Hetil. (Hungary), v. 112, no. 33, 1971 p 1976-1977
(RAE-Lib-Trans-1682; BR33271) Avail: NTIS HC $3.00

Described is a method for measuring aldosterone in urine. After initial purification the aldosterone isolated in a short time in a Mattox and Lewbart formanide, impregnation system, its detection is performed by means of a tetrazolium blue reaction, while the quantitative measurements are made using a Specol spectro-colorimeter. This rapid and simple method can be adopted by laboratories which are not equipped for the determination of hormones. Author

N73-26062# Royal Aircraft Establishment, Farnborough (England).
FRACTIONING AND DETERMINATION OF CORTICOSTEROIDS IN URINE BY THIN LAYER CHROMATOGRAPHY
O. Nishikaze, R. Abraham, and Hj. Staudinger Feb. 1973 11 p refs Transl. into ENGLISH from J. biochem. (Tokyo), v. 54, no. 5, 1963 p 427-431
(RAE-Lib-Trans-1694; BR34103) Avail: NTIS HC $3.00

A method of thin layer chromatography for separating the total urine corticosteroids into five fractions. The method is suitable for use in clinical laboratories for its savings in time and apparatus, and produces fractioning patterns for pathological urines which we feel to be useful for diagnostic evaluation. Standard values for the fractions obtained by this method are reported, together with the results of fractioning for some typical pathological cases. Author

N73-26063*# Hardin-Simmons Univ., Abilene, Tex.
A STUDY OF PSYCHROPHILIC ORGANISMS ISOLATED FROM THE MANUFACTURE AND ASSEMBLY AREAS OF SPACECRAFT TO BE USED IN THE VIKING MISSION, 1 JANUARY - 30 JUNE 1973
Terry L. Foster and Luther Winans, Jr. Jul. 1973 44 p Presented at the Semiannual NASA Spacecraft Sterilization Technol. Seminar, Denver, 11-12 Jul. 1973
(Grant NGR-44-095-001)
(Rept-2) Avail: NTIS HC $4.25 CSCL 06M

Soil samples from the areas associated with the Viking spacecraft were analyzed for major generic groups of microorganisms and the percentage of obligate psychrophiles. Results are presented which show the distribution of organisms isolated at low temperatures and the methods employed for subjecting samples to simulated Martian conditions. Emphasis is placed on application of these results to the objectives of the quarantine program. G.G.

N73-26064*# Scientific Translation Service, Santa Barbara, Calif.
SYNTHESIS RATE OF PHOSPHOLIPIDS AND CYTOCHROMES b5 AND P-450 IN THIAMINE-DEFICIENT RATS AFTER TREATMENT WITH THIAMINE
H. J. Roethig, H. Reinauer, and S. Hollmann Washington NASA Jul. 1973 2 p Transl. into ENGLISH from Herbsttagung der Gesellschaft fuer Biologische Chemie (West Germany), v. 353, 1972 p 1562
(Contract NASw-2483)
(NASA-TT-F-14989) Avail: NTIS HC $3.00 CSCL 06C

The content and synthesis rate of phospholipids in heart, liver, brain and kidney, as well as the content of cytochromes b5 and P450 in the liver of thiamine-deficient rats was investigated. Author

N73-26065*# Techtran Corp., Silver Spring, Md.
ISCHEMIC HEART DISEASE AND COSMIC RADIATION
N. N. Kuchin and Ye. V. Kolomeyets Washington NASA Jul. 1973 10 p Transl. into ENGLISH from Zdravookhr. Kazakhstana (USSR), no. 3, Mar. 1973 p 19-22
(Contract NASw-2485)
(NASA-TT-F-14992) Avail: NTIS HC $3.00 CSCL 06R

A brief exposition is presented of a theory that there is a relationship (inverse) between peaks of cosmic radiation and episodes of myocardial infarct and medullary insult. A brief statistical analysis is given for selected years to support the hypothesis, not considering, however, other seasonal factors.
Author

N73-26066*# Exotech Systems, Inc., Falls Church, Va.
SCIENTIFIC AND TECHNICAL SERVICES DIRECTED TOWARD THE DEVELOPMENT OF PLANETARY QUARANTINE MEASURES FOR AUTOMATED SPACECRAFT Quarterly Progress Report, period ending 30 Jun. 1973
Jul. 1973 40 p ref
(Contract NASw-2503)
(NASA-CR-133202; QR-1) Avail: NTIS HC $4.00 CSCL 06M

The work performed for 12 tasks in the development of planetary quarantine measures is reported. P(st) analysis is discussed along with the early Teflon strip experiment analysis.
F.O.S.

N73-26067*# Research Triangle Inst., Research Triangle Park, N.C.
APPLICATIONS OF AEROSPACE TECHNOLOGY IN BIOLOGY AND MEDICINE Semiannual Report, Sep. 1972 - Feb. 1973
Feb. 1973 100 p
(Contract NASw-2459)
(NASA-CR-133226) Avail: NTIS HC $7.00 CSCL 06E

The results are reported of the medically related activities of the NASA Application Team Program at the Research Triangle Institute. Fourteen medical organizations are presently participating in the RTI Application Team Program: The accomplishments of the Research Triangle Institute Application Team during the reporting period were as follows: The team identified 21 new problems for investigation, accomplished 4 technology applications and 3 potential technology applications, closed 21 old problems, and on February 28, 1973, had a total of 57 problems under active investigation.
Author

N73-26068# Argonne National Lab., Ill. Center for Human Radiobiology.
RADIOLOGICAL AND ENVIRONMENT RESEARCH DIVISION. PART 2: BIOLOGY AND MEDICINE Annual Report, Jul. 1971 - Jun. 1972
Jun. 1972 265 p refs
(Contract W-31-109-eng-38)
(ANL-7960-Pt-2; AR-3) Avail: NTIS

Current work on the development of machine methods for karyotyping chromosomes and scoring aberrations in cases of radiation damage is described. The favored approach is a system of interaction between a human operator and computer programs, employing in ALICE image processing system.
Author (NSA)

N73-26069# Defence Research Information Centre, Orpington (England).
THE USE OF OXYGEN IN THE DECOMPRESSION AND REMEDIAL RECOMPRESSION OF DIVERS
B. A. Zheifets-Tetelbaum, E. E. Rozov et al. Apr. 1973 7 p refs Transl. into ENGLISH from Voenna Med. Zh. (Moscow), Dec. 1970 p 52-54
(DRIC-Trans-3095; BR-30444) Avail: NTIS HC $3.00

The effects of oxygen breathing in decompression sickness and remedial recompression of divers are presented. Some cases of decompression sickness occurring after deep-water submersion are analyzed, and the general characteristics of decompression sickness are given. The choice of the regime of remedial recompression depends on the nature of the symptoms of the sickness and the intensity of their development, and on the depth of descent underwater. It is shown that prevention of decompression sickness requires strict control of the oxygen part of the decompression regime by the doctor, following underwater submersion. In cases where decompression sickness occurs, the application of oxygen in the stage when pressure is reduced during remedial recompression is a promising technique. The increase in the rate of desaturation of the organism from inert gases improves conditions for the dispersion of gas bubbles.
ESRO

N73-26070# Naval Submarine Medical Research Lab., Groton, Conn.
DIFFERENCES IN THE SPEED OF MENTALLY PROCESSING DISPLAYS CONTAINING INFORMATION ABOUT RIGHT AND LEFT Medical Research Progress Report No. 3
Gary M. Olson and Kevin V. Laxar 29 Aug. 1972 19 p refs (MF51524004)
(AD-759723; NSMRL-725) Avail: NTIS CSCL 05/10

The results of a series of experiments using simple word-picture verification tasks showed that the mental representation of the term right is the simpler or unmarked one of the pair right - left, True matches involving the term right took less time than true matches for left or than false matches, and this held whether Ss interpreted the displays from their own perspective or from the perspective of someone facing them. However, substituting arrows for the words in the displays eliminated the effect. Thus, the asymmetry depended upon mentally representing the two directions and not upon visual scanning biases or reading habits. These data are discussed in relation to a general model of how Ss conceptualize space. In addition, problems of S-R compatibility that arise in reaction time tasks using right and left are discussed.
Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-26071* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TEMPERATURE CONTROLLER FOR A FLUID COOLED GARMENT Patent
Alan B. Chambers, James R. Blackaby, and John Billingham, inventors (to NASA) Issued 5 Jun. 1973 9 p Filed 25 Apr. 1972 Supersedes N72-25129 (10 - 16, p 2114)
(NASA-Case-ARC-10599-1; US-Patent-3,736,764; US-Patent-Appl-SN-247481; US-Patent-Class-62-89; US-Patent-Class-165-46; US-Patent-Class-62-176; US-Patent-Class-62-259; US-Patent-Class-62-207; US-Patent-Class-62-209; US-Patent-Class-2-2.1) Avail: US Patent Office CSCL 06Q

An automatic controller for controlling the inlet temperature of the coolant to a fluid cooled garment without requiring skin sensors is described. Temperature is controlled by the wearer's evaporative water loss rate.
E.H.W.

N73-26072* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VISUAL EXAMINATION APPARATUS Patent
Richard F. Haines, James W. Fitzgerald, and Salvadore A. Rositano, inventors (to NASA) Issued 5 Jun. 1973 9 p Filed 6 Jul. 1971 Supersedes N72-21079 (10 - 12, p 1563)
(NASA-Case-ARC-10329-1; US-Patent-3,737,217; US-Patent-Appl-SN-159857; US-Patent-Class-351-23; US-Patent-Class-128-2.1R; US-Patent-Class-351-30; US-Patent-Class-351-36) Avail: US Patent Office CSCL 06B

An automated visual examination apparatus for measuring visual sensitivity and mapping blind spot location is described. The apparatus includes a projection system for displaying to a patient a series of visual stimuli, a response switch enabling him to indicate his reaction to the stimuli, and a recording system responsive to both the visual stimuli per se and the patient's response. The recording system provides a correlated permanent record of both stimuli and response from which a substantive and readily apparent visual evaluation can be made.
Official Gazette of the U.S. Patent Office

N73-26073*# Translation Consultants, Ltd., Arlington, Va.
MECHANICS OF MACHINES, NO. 27/28
I. I. Artobolevskiy Washington NASA Jun. 1973 235 p refs Transl. into ENGLISH of the publ. "Mekhanika Mashin, Volume 27-28" Nauka Press, Moscow, 1971 p 1-171 (Contract NASw-2038)
(NASA-TT-F-14336) Avail: NTIS HC $13.75 CSCL 05H

Theory and methods for analyzing and designing mechanisms for manipulators, and of their systems of manual, bioelectric, and automatic control are reported. For individual titles, see N73-26074 through N73-26092.

N73-26074* Translation Consultants, Ltd., Arlington, Va.
SECOND SYMPOSIUM ON THE THEORY AND PRINCIPLES OF MANIPULATOR DESIGN (FEBRUARY 8-9, 1968)
I. I. Artobolevskiy and A. Ye. Kobrinskiy *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 1-3 (For availability see N73-26073 17-05)
CSCL 05H

The theory and principles of manipulator design is discussed. Different uses of manipulators are presented, including their use as space equipment. Designations are suggested for the basic elements of a manipulator. Author

N73-26075* Translation Consultants, Ltd., Arlington, Va.
FEATURES OF THE KINEMATICS OF MANIPULATORS AND VOLUMES METHODS
I. B. Vinogradov, A. Ye. Kobrinskiy, Yu. A. Stepanenko, and L. I. Tyves *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 4-19 refs (For availability see N73-26073 17-05)
CSCL 05H

A volumetric method of kinematic analysis of a manipulator which can be used in addition to the conventional trajectory method is presented. An ideal manipulator, the influence of limitations on the angles of rotation of the manipulator, and a manipulator with limitations in all joints are discussed. Author

N73-26076* Translation Consultants, Ltd., Arlington, Va.
SOME REMOTELY CONTROLLED MASTER-SLAVE MANIPULATOR DESIGN PROBLEMS
N. A. Lakota and V. I. Lobachev *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 20-36 refs (For availability see N73-26073 17-05)
CSCL 05H

A number of specific requirements for designing remotely controlled master-slave manipulators, including the kinematics and the dimensions of the master and slave members, are presented. General requirements for master-slave manipulator control systems are discussed. Author

N73-26077* Translation Consultants, Ltd., Arlington, Va.
KINEMATIC ANALYSIS OF SPATIAL SLAVE MECHANICS FOR MANIPULATORS BY THE MATRIX METHOD
Ye. I. Vorobyev *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 37-47 refs (For availability see N73-26073 17-05)

The use of spatial mechanisms with many degrees of freedom as manipulator slave mechanisms is discussed. An anslysis of these mechanisms by the matrix of 3rd order method is presented. Author

N73-26078* Translation Consultants, Ltd., Arlington, Va.
SOME QUESTIONS OF THE DISCRETE CONTROL OF DEEP-WATER MANIPULATORS
E. L. Onishchenko *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 48-57 refs (For availability see N73-26073 17-05)
CSCL 05H

The use of manipulators to take geological samples and install measuring instruments on the ocean floor is discussed. Methods of performing complex operations using a manipulator connected by cable to the command element are presented. Author

N73-26079* Translation Consultants, Ltd., Arlington, Va.
PROSPECTS FOR THE BUILDING AND USE OF COMPUTER CONTROLLED MANIPULATORS
M. B. Ignatyev, F. M. Kulakov, and A. M. Pokrovskiy *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 58-72 refs (For availability see N73-26073 17-05)
CSCL 05H

The economic advantages of computer controlled manipulators are discussed. The basic stages of the work required to build automatic manipulators, as well as a linguistic approach to the synthesis of control programs for manipulator movement, are also presented. Author

N73-26080* Translation Consultants, Ltd., Arlington, Va.
SOME PRINCIPLES INVOLVED IN THE CONSTRUCTION OF UNAMPLIFIED CONTROL SYSTEMS FOR ELECTRO-MECHANICAL MANIPULATORS
Ya. I. Aronov *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 73-82 refs (For availability see N73-26073 17-05)
CSCL 05H

The requirements for manipulator control systems are listed. General principles involved in the construction of unamplified reversible follow-up systems using selsyns are discussed. Author

N73-26081* Translation Consultants, Ltd., Arlington, Va.
PRINCIPAL PARAMETERS AND OPERATING INDICES FOR REVERSIBLE FOLLOW-UP SYSTEMS
V. S. Kuleshov and I. N. Yegorov *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 83-97 refs (For availability see N73-26073 17-05)
CSCL 05H

An engineering approach to the analysis of the principal parameters and operating indices for reversible follow-up systems is presented. Structurally symmetrical and structurally asymmetrical systems are discussed. Author

N73-26082* Translation Consultants, Ltd., Arlington, Va.
SOME QUESTIONS FROM THE USE OF REVERSIBLE FOLLOW-UP SYSTEMS WITH INDEPENDENT FOLLOW-UP AND FORCE REPRODUCTION CHANNELS
B. A. Petrov and V. Ye. Paramonov *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 98-112 refs (For availability see N73-26073 17-05)
CSCL 04H

The use of independent follow-up and force reproduction channels in manipulators are discussed. The question of selecting the site of operator influence, as well as of the use of the slave mechanism as the reproduction channel output, are considered. Author

N73-26083* Translation Consultants, Ltd., Arlington, Va.
AN ANALYTICAL METHOD FOR THE SYNTHESIS OF REVERSIBLE FOLLOW-UP SYSTEMS
M. S. Voroshilov *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 113-130 (For availability see N73-26073 17-05)
CSCL 05H

The technical and design requirements of reversible follow-up systems are presented. A synthesis scheme is proposed for the realization of these requirements. Author

N73-26084* Translation Consultants, Ltd., Arlington, Va.
THE QUESTION OF MANIPULATOR ACTIVATION BY REVERSIBLE FOLLOW-UP SYSTEMS
Yu. A. Stepanenko *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 131-137 refs (For availability see N73-26073 17-05)
CSCL 04H

The problems of manipulator activation by reversible follow-up systems in each of the drives are discussed. These include the mismatches between input and output coordinates, and the manipulator tongs and their corresponding master arm element, as well as the problems of precision and activation in one drive and the simultaneous operation of all drives. Author

N73-26085* Translation Consultants, Ltd., Arlington, Va.
AN INVESTIGATION OF ENGINEERING METHODS OF DESIGNING ELECTROHYDRAULIC FOLLOW-UP DRIVES FOR UNDERWATER MANIPULATORS
V. S. Yastrebov *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 138-153 refs (For availability see N73-26073 17-05)
CSCL 04H

Engineering methods of analysis and synthesis of electrohydraulic control system for underwater manipulators with position feedbacks are discussed. An approximation of a control system by an aperiodic unit is presented. Author

N73-26086* Translation Consultants, Ltd., Arlington, Va.
THE FIRST EXPERIMENT IN BUILDING AN AIRTIGHT MAGNETOMECHANICAL MASTER-SLAVE MANIPULATOR
V. A. Ovsyannikov *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 154-161 refs (For availability see N73-26073 17-05)
CSCL 05H

The use of magnetic couplings to make manipulators airtight is discussed. The special properties of magnetic couplings and magnetomechanical transmissions making their use in manipulators advantageous are presented. Author

N73-26087* Translation Consultants, Ltd., Arlington, Va.
THE INFLUENCE OF MANIPULATOR KINEMATICS ON THE SELECTION OF THE GEOMETRIC PARAMETERS OF BOXES AND CHAMBERS
G. I. Lukishov and Yu. V. Miloserdin *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 162-173 refs (For availability see N73-26073 17-05)
CSCL 05H

The role working condition kinematics play in selecting the geometric parameters of boxes and chambers is discussed. Efficiency and cost factors are evaluated. Author

N73-26088* Translation Consultants, Ltd., Arlington, Va.
PRINCIPLES OF THE CURTAILMENT OF SOURCES OF COMMAND SIGNAL IN MULTIFUNCTIONAL BIOELECTRIC CONTROL SYSTEMS
Ye. P. Polyan, A. Yu. Shneyder, and E. I. Plamm *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 174-186 refs (For availability see N73-26073 17-05)
CSCL 05H

Bioelectric control systems for several slave mechanisms using a single muscle are discussed. Author

N73-26089* Translation Consultants, Ltd., Arlington, Va.
SYNCHRONISM AND HETEROCHRONISM OF SYNKINESIS IN MAN
I. P. Blokhin, A. B. Gandelsman, G. S. Kan, and A. M. Pokrovskiy *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 187-199 refs (For availability see N73-26073 17-05)
CSCL 05H

The potentials of arbitrary synchronization of synkinesis in man is studied, as are elementary flexing and extension single joint movements of the different links in the body. Author

N73-26090* Translation Consultants, Ltd., Arlington, Va.
THE POSSIBILITIES OF MAKING QUANTITATIVE EVALUATIONS OF THE FUNCTIONING OF CLOSED PEOPLE-OPERATOR CONTROL SYSTEMS
V. A. Taran, A. D. Korotkov, Yu. N. Kofanov, A. A. Belov, and I. G. Shramkov *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 200-219 refs (For availability see N73-26073 17-05)
CSCL 05H

The three tasks comprising the specific sections of the general methodology for evaluating ergatic systems are reviewed. Author

N73-26091* Translation Consultants, Ltd., Arlington, Va.
THE QUESTION OF MODELING CERTAIN MOTOR FUNCTIONS OF THE HUMAN ARM
A. V. Smirnov and B. S. Yastrebov *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 220-225 refs (For availability see N73-26073 17-05)
CSCL 05H

The modeling of the motor functions of the human arm by master-slave manipulators is discussed. The use of the lateral pulse method to modulate the control signal is presented. Author

N73-26092* Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF THE SPATIAL POSITIONS OF THE LINKS IN A MANIPULATOR MECHANISM
A. V. Sinev and Yu. A. Stepanenko *In its* Mech. of Machines, no. 27/28 Jun. 1973 p 226-231 refs (For availability see N73-26073 17-05)
CSCL 05H

Screw calculus methods are used in an effort to determine the position of a manipulator in space. Author

N73-26093*# Techtran Corp., Silver Spring, Md.
THE WORK AND REST REGIME OF COSMONAUTS
Ye. Karpov and V. Bodrov Washington NASA Jul. 1973 8 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (Moscow), no. 5, May 1973 p 38-39
(Contract NASw-2485)
(NASA-TT-F-14990) Avail: NTIS HC $3.00 CSCL 05E

The cosmonauts work-rest regime is discussed as a major problem to be overcome in space flight. The essential phytological and physiological problems encountered (disruptions of the sleep-wakefulness cycle, poor quality sleep, loss of appetite) and possible ways to overcome them are cited. A chart is provided for a crew regime for crews consisting of various numbers of persons. The schedule in the chart does not provide optimum results. Author

N73-26094*# AiResearch Mfg. Co., Los Angeles, Calif.
INTERMEDIATE WATER RECOVERY SYSTEM Final Report
G. Deckman and A. R. Anderson, ed. 12 Apr. 1973 117 p
(Contract NAS9-11996)
(NASA-CR-128983; Rept-72-8901-Rev-1) Avail: NTIS HC $8.00 CSCL 06I

A water recovery system for collecting, storing, and processing urine, wash water, and humidity condensates from a crew of three aboard a spacecraft is described. The results of a 30-day test performed on a breadboard system are presented. The intermediate water recovery system produced clear, sterile, water with a 96.4 percent recovery rate from the processed urine. Recommendations for improving the system are included. F.O.S.

N73-26095# Acurex Corp., Mountain View, Calif. Aerotherm Div.
ANALYSIS OF THE THERMAL RESPONSE OF PROTECTIVE FABRICS Technical Report, Jun. 1971 - Jun. 1972
Howard L. Morse, James G. Thompson, Kimble J. Clark, Kenneth A. Green, and Carl B. Moyer Wright-Patterson AFB, Ohio AFML Jan. 1973 221 p refs
(Contract F33615-72-C-1298; AF Proj. 7320)
(AD-759525; AFML-TR-73-17) Avail: NTIS CSCL 06/17

The objective of the program was to develop a theoretical and empirical mathematical relationship to define the fabric-skin system's response when exposed to a JP-4 fuel fire. Critical fabric parameters, such as optical, thermo-chemical and physical characteristics are defined in a manner which will allow the fabric designer to develop improved thermally protective light weight fabrics. The computer code evaluates the model parameter variation in terms of resultant human skin burns. A comparison of the analytical model results with laboratory and fire pit data demonstrates excellent correlation within the limits of the present study. (Author Modified Abstract) GRA

N73-26096# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
RELATIONSHIPS BETWEEN DESIGN CHARACTERISTICS OF AVIONICS SUBSYSTEMS AND TRAINING COST, TRAINING DIFFICULTY, AND JOB PERFORMANCE Final Report, 1 Jul. 1971 - 1 Sep. 1972
Larry M. Lintz, Susan L. Loy, Raymond Hopper, and Kenneth W. Potempa Jan. 1973 65 p refs
(Contract F33615-71-C-1620; AF Proj. 1124)
(AD-759583; AFHRL-TR-72-70) Avail: NTIS CSCL 05/9

The relationships between subsystem design characteristics, training cost, training difficulty, and job performance were investigated for avionics subsystems. A list of relevant design characteristics was established. Functional loops were selected from 10 subsystems representing navigation, flight control, communications, and fire control subsystems. Performance tests for each of the 30 functional loops were identified or constructed. Ten AF students performed each of the tests. Time and errors were recorded for using equipment and reading technical orders (T.O.'s). Both stepwise regressions and factor analysis were used to derive equations to predict performance time, training time, T.O. time, errors, and training equipment cost from equipment design characteristics, personnel characteristics, and environmental variables. Multiple correlation coefficients were 0.88 or greater. Factors of length of checkout procedure, equipment complexity, difficulty of checkout steps, nonautomatic checkout, diagnostic

information, and clarity of information were identified. Applications of these equations should, for the present, be made cautiously, particularly if any of the input data fall outside the ranges which entered into derivation of the equations. (Author Modified Abstract) GRA

N73-26097# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
THE USAF AIRCRAFT MAINTENANCE MANPOWER PROCESS: 1947 THROUGH 1972 M.S. Thesis
Gustav S. VonWolffradt and Gary D. Worrell 7 Mar. 1973 140 p refs
(AD-760082; SLSR-5-73A) Avail: NTIS CSCL 05/9

Since manpower is the largest consumer of Air Force dollars, the problem of determining accurate manpower requirements has been present throughout the existence of the Air Force. An emphasis is placed on accurate maintenance manning, primarily due to the scale of the maintenance task. The problem is that no systematic research has been performed to determine if current methods provide for an equitable distribution of aircraft maintenance manpower within the constraints of efficient resource utilization. The thesis identifies conditions that have molded manpower and maintenance policies in the past and follows their evolving path to the methods of determining aircraft maintenance manpower as of 1972. GRA

N73-26098# Naval Submarine Medical Research Lab., Groton, Conn.
HANDEDNESS AND ADAPTATION TO DISTORTIONS OF SIZE AND DISTANCE UNDER WATER Medical Research Progress Report
S. M. Luria, Christine L. McKay, and Steven H. Ferris 28 Aug. 1972 19 p refs
(AD-759722; NSMRL-724; PR-12) Avail: NTIS CSCL 05/10

Both before and after 15 minutes of adaptation under water, 20 right-handed and 20 left-handed or ambidextrous subjects made size matches to standard rectangles and were tested for hand-eye coordination. Nearly all showed a reduction in the amount of distortion to position after adaptation with no significant differences as a function of handedness. In other respects, however, the two groups showed great dissimilarities. The results for the right-handers were consonant with previous reports of a negative correlation between magnitudes of adaptation to size and distance, but this was not true for the left-handers. The effect of previous diving experience also differed for the two groups. Finally, the left-handers consistently showed increased distortion in the perception of size after adaptation, but the right-handers did not. Thus, only the left-handers showed true counter-adaptation (increased distortion after adaptation) but only the right-handers showed negative correlations between two modalities of adaptation. (Author Modified Abstract) GRA

N73-26099# Army Environmental Hygiene Agency, Edgewood Arsenal, Md.
EVALUATION OF HADRON MODEL 112 LASER SAFETY EYESHIELDS, JANUARY - MARCH 1973 Radiation Protection Special Study
David H. Sliney and James E. Walkenback 2 May 1973 18 p refs
(AD-759921; USAEHA-42-57-73) Avail: NTIS CSCL 06/17

Four types of Hadron laser safety eyeshields were evaluated from the standpoint of adequacy for protecting personnel from accidental ocular exposure from most common lasers. The eyeshields were found to be adequate to protect personnel exposed to the direct beam, or reflections of the direct beam, of most commercially available lasers. Tests using several types of lasers revealed that the eyeshields had optical densities as specified by the manufacturer within the measurement capabilities of this agency. (Author Modified Abstract) GRA

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-26100* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW OUTGASSING POLYDIMETHYLSILOXANE MATERIAL AND PREPARATION THEREOF Patent
Benjamin Seidenberg, inventor (to NASA) Issued 15 May 1973 3 p Filed 15 Feb. 1972 Supersedes N72-22113 (10 - 13, p 1704)
(NASA-Case-GSC-11358-1; US-Patent-3,733,350; US-Patent-Appl-SN-226551; US-Patent-Class-260-46.5R) Avail: US Patent Office CSCL 07D

A fluid polydimethylsiloxane resin having improved outgassing properties in the cured state is described. The fluid resin is obtained by pouring, to a height of up to about 2 inches a starting polydimethylsiloxane resin such as RTV-602 silicone resin and devolatilizing the starting resin at a temperature of about 125 to 150 C under a vacuum of at least 0.00001 torr.
Official Gazette of the U.S. Patent Office

N73-26101 Yale Univ., New Haven, Conn.
A STUDY ON VAPOR CONDENSATION BY HOMOGENEOUS NUCLEATION IN NOZZLES Ph.D. Thesis
Benjamin Ju-Cheng Wu 1972 121 p
Avail: Univ. Microfilms Order No. 73-807

An analytic study is presented on vapor condensation by homogeneous nucleation occurring in expansions in supersonic nozzle flows. New explicit steady-state growth equations for spherical droplets covering various temperature ranges are derived for free molecular flow conditions and a method is suggested for estimating the effect of droplet coagulation on the overall rate of condensation. Experimental data of various laboratories studied include the results on condensation of C6H6NH3, CCl3F, CHCl3, C2H5OH and H2O vapors respectively, carried in an inert diluent. Moreover, the condensation of pure N2 and H2O is considered. The results of the comparison of theory and experiment show that H2O and C2H5OH vapors carried in air condense as roughly predicted by the classical theory of homogeneous nucleation using the bulk value of surface tension. Dissert. Abstr.

N73-26102*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Chemistry.
INFRARED SPECTRA OF GROUP III A METAL OXIDES
Denis Aloysius Lynch, Jr. Jun. 1972 138 p refs Sponsored jointly by NASA and NSF
(NASA-CR-133100) Avail: NTIS HC $9.00 CSCL 07D

The measurement of infrared frequencies of metal-oxygen species which could be formed in the matrix and to investigate with an oxygen-18 enrichment study the controversy on the vibrational assignments for the suboxide. Several new molecules, Al3O2, Ga3O, In3O, In4O2, Inta0, InteO2, and In2WO4, were found by mass spectrometric sampling to exist in extremely minor concentrations in the vapor phase. The latter three species were formed by reaction with the crucible materials and were unimportant for an infrared analysis. The infrared spectroscopic measurements were obtained by the matrix isolation technique of molecular beam sampling. The MO2 species were formed by direct reaction between metal and O2 in the matrix. A C2v structure and an O-M-O bond angle near 40 deg was favored for these molecules by analogy with a similar investigation of the alkali metals. The vibrational frequencies which were determined are given. Author

N73-26103# Royal Aircraft Establishment, Farnborough (England).
NMR-SPECTROSCOPIC INVESTIGATIONS INTO THE RING INVERSION OF 1,3-DIHYDRO-5-PHENYL-1, -4-BENZODIAZEPINE-2-ONE-DERIVATIVES
W. Sadee Oct. 1972 11 p refs Transl. into ENGLISH from Arch. Pharm. (West Germany), v. 302, no. 10, 1969 p 769-774
(RAE-Lib-Trans-1628; BR-32027) Avail: NTIS HC $3.00

NMR-spectra of some benzodiazepine-derivatives are given and the conformation of this ring system is discussed. The influence of various substituents on the rate of ring inversion was investigated. Author

N73-26104# Royal Aircraft Establishment, Farnborough (England).
THE SYNTHESIS OF SILOXANE POLYMERS WITH POLYFLUORO AROMATIC GROUPS AT THE ATOMS OF SILICON
Yu. A. Yuzhelevskii, E. G. Kagan, A. L. Klebanskii, I. A. Zevakin, and A. V. Kharlamova Nov. 1972 11 p refs Transl. into ENGLISH from Vysokomolekul. Soedin. (Moscow), v. 11, no. 11, 1969 p 854-856
(RAE-Lib-Trans-1669; BR-32520) Avail: NTIS HC $3.00

The condensation of methyl(pentafluorophenyl) diethoxysilane, methyl(tetrafluorochlorophenyl)diethoxysilane and bis(pentafluorophenyl)diethoxysilane respectively with 1.3-dichlorotetramethyldisiloxane using electrophilic catalysts are described. The results of homo-and-co-polycondensation with dimethyldichlorosilane of bis(dimethylchlorosill) tetrafluorobenzene and methyl(pentafluorophenyl)dichlorosilane are reported. Properties and T sub g values of the resultant polymers are discussed. Author

N73-26105*# Linguistic Systems, Inc., Cambridge, Mass.
DETERMINING THE MINERALIZATION OF CHLORIDE CALCIUM-SODIUM WATERS BY THEIR SPECIFIC ELECTROCONDUCTIVITY
A. I. Korotkov Washington NASA Jul. 1973 5 p Transl. into ENGLISH from Razvedka i Okhrana Nedr (Moscow), v. 35, no. 10, 1969 p 51-52
(Contract NASw-2482)
(NASA-TT-F-14991) Avail: NTIS HC $3.00 CSCL 07D

The difficulty of analytically determining the mineralization of water as a function of its specific electroconductivity is discussed. A study was made of the mineralization and the specific electroconductivity of the ground and surface waters around the city of Porkhov. As a result, several linear relationships were proposed which can be used to approximately determine the mineralization of waters as a function of their specific electroconductivity. These formulas use a correction coefficient to take into account the temperature of the water. Author

N73-26106# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
DEVELOPMENT OF HIGH SENSITIVITY X-RAY FLUORESCENCE FOR ANALYSIS OF TOXIC HEAVY ELEMENTS
C. J. Sparks, Jr. and L. A. Harris 1972 9 p refs Presented at 3d Trace Metals Symp., Urbana, Ill., 21 Nov. 1972 Sponsored in part by NSF
(Conf-721134-1) Avail: NTIS

By adapting a compression annealed pyrolytic graphite monochromator to reduce the white radiation from the X-ray target and by placing a second doubly curved graphite monochromator between the sample and the Si(Li) detector, the detectable limits were lowered to 200 ppB for mercury. NSA

N73-26107# Sandia Labs., Albuquerque, N.Mex.
VAPOR COMPOSITION AND CHEMICAL REACTIONS OF CARBON ATOMS AND MOLECULES FROM GRAPHITE AND FROM TANTALUM CARBIDE HEATED BY LASER RADIATION
R. T. Meyer, A. W. Lynch, and J. M. Freese Feb. 1973 43 p refs
(SLA-73-57) Avail: NTIS HC $4.25

The vapor composition above graphite and above tantalum carbide together with the chemical reactions of C1, C2, and C3 were studied by the techniques of pulsed laser heating, time-resolved mass spectrometry, and gas phase titrations. The relative abundances for the vaporized species C1, C2, and C3 were 1.0:1.4:17 for graphite and 1.0:0.59:2.2 for tantalum carbide. The different relative abundances of vaporized species from graphite and from tantalum carbide were selected to provide an identification of some of the specific gas phase reactions with O2, H2, and CH4. The O2 titration procedure allowed a determination of the relative amount of mass loss as vapor and as particulate matter. C2H2 was the major product of reactions with H2 and accounted for 85 to 90 percent of the mass loss from graphite. Author (NSA)

N73-26108# California Univ., Berkeley. Lawrence Berkeley Lab.
MASS-SPECTROMETERIC INVESTIGATION OF LASER-INDUCED VAPORIZATION OF BINARY SOLID COMPOUNDS Ph.D. Thesis
R. A. Olstad Dec. 1972 198 p refs
(Contract W-7405-eng-41)
(LBL-1177) Avail: NTIS HC $12.00

The laser-induced vaporization of iron and of a binary solid compound, zirconium hydride, was studied using a quadrupole mass spectrometer. A Q-switch ruby laser with pulse width of 80 ns was used to heat zirconium hydride samples under high vacuum to temperatures up to 2500 C. The mass spectrometer ionizer was located in a line-of-sight path 40 cm from the target. By an analysis of the measured mass-spectrometer signals, the rate of vaporization of hydrogen during the rapid temperature transient could be determined. Application of an equilibrium model to the vaporization process predicts that predominantly H2 should be emitted. Author (NSA)

N73-26109# California Univ., Irvine. Dept. of Physics.
PHONON CONTRIBUTION TO THE FREE ENERGY OF INTERACTING ATOM PAIRS
S. L. Cunningham, L. Dobrzynski, and A. A. Maradudin Apr. 1973 32 p refs
(Contract N00014-69-A-0200-9003; Grant AF-AFOSR-71-2018; NR Proj. 015-731)
(AD-759035; TR-72-53) Avail: NTIS CSCL 07/4

The free energy(Delta F) due to the interaction through the crystal phonon field of two identical atoms adsorbed on a (100) surface of a simple cubic monatomic lattice is studied within the framework of the Montroll-Potts model. The zero-point energy of interaction (Delta E(0)) is found analytically in the limit of large separation distances, and numerical results are presented for small separation distances. The leading temperature dependent terms in the expansion of Delta F are given in closed form in both the low and high temperature limits. The results are given as a function of the mass and separation distance of the adsorbed atoms and as a function of the force constant binding the adsorbed atoms to the surface. For all values of the model parameters, it was found that the free energy decreases with the separation distance. (Author Modified Abstract) GRA

N73-26110# Princeton Univ., N.J. Dept. of Chemistry.
SYNTHESIS AND CHARACTERIZATION OF RARE EARTH TETRAHYDROBORATES Technical Report, 28 Feb. 1972 - 1 Mar. 1973
Elliot R. Bernstein and Kuo M. Chen 2 Apr. 1973 20 p refs Submitted for publication
(Contract N00014-67-A-0151-0032; NR Proj. 056-528)
(AD-759372; TR-3) Avail: NTIS CSCL 07/2

Rare earth tetrahydroborates (RE = La, Nd, and Er) have been synthesized via the reactions of RE (OMe)3 with diborane in THF and RE (OMe)3 with Al (BH4)3 in the absence of solvent. The major products of these reactions have been identified to be RE(BH4)3:3THF and RE(BH4)3, respectively. Electronic, vibrational, and proton magnetic resonance spectra are reported for the various compounds. The covalent bonding of borohydride groups with rare earth ions is discussed. Author (GRA)

N73-26111# California Univ., Berkeley. Dept. of Chemistry.
ELECTRO-OPTIC DATA ACQUISITION AND PROCESSING
John W. Jost and Chester T. OKonski 1973 46 p refs Submitted for publication
(Contract N00014-69-A-0200-1061; NR Proj. 053-546)
(AD-759421; TR-1) Avail: NTIS CSCL 07/4

Methods for the analysis of electro-optic relaxation data are discussed. Emphasis is on numerical methods using high speed computers. A data acquisition system using a minicomputer for data manipulation is described. Relationship of the results obtained here to other possible uses is given. Author (GRA)

N73-26112# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
THE VISIBLE FLUORESCENCE AND THERMOLUMINESCENCE OF YAIO3 CRYSTALS CONTAINING Er, Eu, Nd, Tb, OR Yb AND OTHER OPTICALLY ACTIVE CENTERS
Peter L. Land Feb. 1973 56 p refs
(AF Proj. 7021)
(AD-759161; ARL-73-0007) Avail: NTIS CSCL 07/4

The visible emission and UV excitation spectra for UV excitation of YAlO3 containing Er, Eu, Nd, Tb or Yb and other optically active centers are measured. All emission lines from the same rare earth have the same excitation spectra with exception of two line groups for Er(3-) near 5300A. All lines broaden with increasing temperature and the fluorescence efficiency generally decreases; in some cases this is offset by a shift and broadening of the excitation peak and or by a decrease in UV induced coloration. The excitation spectra, temperature dependence of fluorescence and annealing temperatures are measured for several fluorescence bands which are associated with centers that are either stable between -196 and 1000C, UV induced and thermally annealed between -196 and 500C, or induced by heating the as-grown crystals in air to 870C. The annealing of some of the UV induced color and fluorescent centers correlates with the activation of trapped charges which causes the major part of the thermoluminescence which occurs between 300 and 400C in these crystals. The observed properties are compared with impurity levels and possible correlations are noted. Author (GRA)

N73-26113# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
THE VAPORIZATION COEFFICIENT OF GRAPHITE Final Report, 1 Apr. 1970 - 1 Jan. 1972
Michael Hoch and Michio Yamawaki Dec. 1972 55 p refs
(Contract F33615-69-C-1531; AF Proj. 7360)
(AD-759203; AFML-TR-72-273) Avail: NTIS CSCL 07/4

Relative values of the vaporization coefficients of C, C2, and C3, the predominant vapor species of graphite, were evaluated by comparing the ratios between the ion intensities of different carbon vapor species obtained in a free (Langmuir) vaporization experiment and in an equilibrium (Knudsen) vaporization experiment. The measurements of the ion intensities of carbon vapor species over the spectrographic electrode grade graphite were carried out using a RF induction heating furnace coupled with a Bendix Time-of-Flight mass spectrometer. The data in literature on pyrolytic graphite was also analyzed; an interpretation of the vaporization coefficients of pyrolytic graphite is difficult as the pyrolytic graphite vaporizes predominantly from cracks, etc. (Author Modified Abstract) GRA

N73-26114# Army Electronics Command, Fort Monmouth, N.J.
FREEZING WATER WITH SIZED AgI PARTICLES. PART 1: A SURVEY
Hermann E. Gerber Mar. 1973 22 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-758857; ECOM-5477-Pt-1) Avail: NTIS CSCL 07/4

A survey was made of previous experimental and theoretical attempts to determine the AgI particle size-ice nucleating activity relationship. This relationship is important since the successful phase transformation of water to ice in a supercooled cloud must depend on both the concentration and size of the injected AgI particles. Fletcher's classical sublimation theory was found to be inconsistent with the few existing experimental results. The surprising conclusion was reached that a proven explanation of the behavior of AgI as a function of particle size has not been given. The Goetz Aerosol Spectrometer is suggested as the instrument capable of measuring the long elusive AgI particle size-activity relationship. Author (GRA)

N73-26115# California Univ., Los Angeles. Dept. of Chemistry.
ABSOLUTE POLARIZATION AND MICROWAVE OPTICAL-PHOTOSELECTION SPECTROSCOPY (MOPS) OF THE ZEROFIELD TRANSITIONS OF THE TRIPLET STATE
M. A. El-Sayed, E. Gossett, and M. Leung May 1973 22 p refs
(Contract N00014-69-A-0200-4012; NR Proj. 056-498)
(AD-759996; TR-16) Avail: NTIS CSCL 07/4

By replacing the helix with an external horn in the phosphorescence-microwave double resonance (PMDR) experiment, the polarization characteristics of the microwave radiation could be used. The determination of the absolute polarization and thus the assignment of the zerofield (zf) transitions and their hyperfine structure is made conveniently if mixed single crystals are used and the intensity of the optically detected microwave signals are determined along the different crystal axes. The potential use of these experiments in determining the orientation and type of distortion of probe molecules embedded in the solid state as well as triplet-triplet energy transfer orientation dependence is briefly discussed. (Author Modified Abstract) GRA

N73-26116# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
THERMODYNAMIC PROPERTIES OF ORGANIC DERIVATIVES OF THE LIGHTER ELEMENTS AND THERMODYNAMIC PROPERTIES OF FLUIDS Final Annual Technical Summary Report, 1 Mar. 1972 - 1 Mar. 1973
Donald R. Douslin, William D. Good, Herman L. Finke, John F. Messerly, and Ann Osborn 1 Mar. 1973 20 p refs
(AD-760156; AFOSR-73-0760TR) Avail: NTIS CSCL 07/4

An investigation of strained small ring systems as possible group constituents in synthetic high energy fuels was continued. The purification of research samples of 1,2-epoxybutane, trans-2,3-epoxybutane, and cyclopentylamine is described. Thermodynamic properties for 1,2-epoxybutane in the liquid state are reported. Conversion to the gaseous state awaits vapor pressure measurements which are in progress. Vapor pressure and enthalpy-of-vaporization measurements were completed for trans-2,3-epoxybutane. Combustion and low-temperature thermal measurements are in progress; however, these data indicate that the sample purity may not be adequate for some of the properties. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-26117* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
COLLAPSIBLE HIGH GAIN ANTENNA Patent
Herbert E. Cribb, inventor (to NASA) Issued 5 Jun. 1973 5 p Filed 16 Sep. 1971 Supersedes N72-20168 (10 - 11, p 1441)
(NASA-Case-KSC-10392; US-Patent-3,737,912;
US-Patent-Appl-SN-181024; US-Patent-Class-343-880;
US-Patent-Class-343-889; US-Patent-Class-343-895;
US-Patent-Class-343-883) Avail: US Patent Office CSCL 17B

A lightweight small high gain antenna which is capable of being packaged in a collapsed form and automatically expanded when in use is described. The antenna includes a cylindrical housing having a rod with a piston adjacent to one end extending through it. Attached to the outer end of the rod in a normally collapsed state is a helical wire coil. When the gas producing means is activated the piston and rod are shifted outwardly to expand the wire coil. A latch is provided for holding the helical coil in the expanded position. Official Gazette of the U.S. Patent Office

N73-26118* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TWO CARRIER COMMUNICATION SYSTEM WITH SINGLE TRANSMITTER Patent
Mahlon F. Easterling, inventor (to NASA) Issued 5 Jun. 1973 6 p Filed 9 Jun. 1971 Supersedes N71-34161 (09-21, p 3395)
Sponsored by NASA
(NASA-Case-NPO-11548; US-Patent-3,737,776;
US-Patent-Appl-SN-151411; US-Patent-Class-325-40;
US-Patent-Class-179-15A; US-Patent-Class-179-15BM;
US-Patent-Class-343-204) Avail: US Patent Office CSCL 17B

A pulse code modulated communication system is disclosed for transmitting two subcarrier modulated carriers from a single transmitter comprising two channels for phase modulating the two carriers independently. The modulating subcarriers are independently modulated by data and/or pseudonoise (PN) codes

as desired. The modulated carriers are switched alternately to the single transmitter in synchronism with operation of a PN code generator when PN code modulation is present, as for ranging. Official Gazette of the U.S. Patent Office

N73-26119* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH PULSE RATE HIGH RESOLUTION OPTICAL RADAR SYSTEM Patent
Willis C. Goss, Richard H. Burns, and Ko-Chuan Chi, inventors (to NASA) Issued 5 Jun. 1973 4 p Filed 13 Nov. 1970 Supersedes N71-33107 (09 - 20, P 3232) Sponsored by NASA
(NASA-Case-NPO-11426; US-Patent-3,737,231; US-Patent-Appl-SN-89210; US-Patent-Class-356-5; US-Patent-Class-356-4; US-Patent-Class-332-7.51; US-Patent-Class-250-199; US-Patent-Class-331-94.5) Avail: US Patent Office CSCL 20I

The system is composed of an optical cavity with a laser and a mode locking means to build up an optical pulse. An optical switch is also provided within the cavity to convert the polarization of the optical pulse generated within the cavity. The optical switch comprises an electro-optical crystal driven by a time delayed driver circuit which is triggered by a coincident signal made from an optical pulse signal and a gating pulse signal. The converted optical pulse strikes a polarization sensitive prism and is deflected out of the cavity toward the pending target in the form of a pulse containing most of the optical energy generated by the laser in the pulse build-up period. After striking the target, the reflected energy is picked up by a transceiver with the total travel time of the pulse being recorded. Official Gazette of the U.S. Patent Office

N73-26120 Georgetown Univ., Washington, D.C.
CHARACTERISTICS OF ANTENNA ARRAYS OF SUPERCONDUCTING POINT CONTACT JOSEPHSON JUNCTIONS Ph.D. Thesis
Dominic J. Repici 1972 135 p
Avail: Univ. Microfilms Order No. 72-34188

The dc and RF characteristics of planar arrays of Josephson point contacts, as first proposed by Clark were investigated. Such square arrays, composed of 1 mm diameter solid tin spheres arranged in a 10 x 10 x 1 matrix, are shown to generate coherent RF radiation whose free space wavelengths of 1.2 mm and 101 microns were identified. A self detection technique is employed whereby the array is placed parallel to and midway between two parallel mirrors. The array is irradiated with approximately 40 nanowatts of externally generated 97 gHz (200 microvolts) microwave radiation via a 2.25 mm hole in one mirror. Photon assisted tunneling is observed and the RF response, whose structure at 1.8 mv is indicative of coherent detection, is shown to be the second derivative of the I,V characteristics. From the I,V characteristics and from the RF response of the array under external radiation, one can determine not only that the array acts as a fast coherent detector capable of resolving the incident 97 gHz radiation, but also one can estimate that between 10 and 100 nanowatts of RF power are actually radiated by the array. Dissert. Abstr.

N73-26121# Advisory Group for Aerospace Research and Development, Paris (France).
TELECOMMUNICATIONS ASPECTS ON FREQUENCIES BETWEEN 10 AND 100 GHz
Albert W. Biggs, ed. (Kansas Univ., Lawrence) Apr. 1973 246 p refs Presented at Electromagnetic ,Wave Propagation Panel Tech. Meeting, Gausdal, Norway, 18-21 Sep. 1972
(AGARD-CP-107) Avail: NTIS HC $14.50

The general loss mechanisms of ultrahigh frequency telecommunication systems are studied. Considered are effects of atmospheric absorption and rainfall on radio transmission. For individual titles, see N73-26122 through N73-26143.

N73-26122 Washington Univ., Seattle. Dept. of Electrical Engineering.
MULTIPLE SCATTERING EFFECTS ON WAVE PROPAGATION THROUGH RAIN
Akira Ishamaru and James C. Lin *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 13 p refs (For availability see N73-26121 17-07)

The multiple scattering effects of a wave propagating through rain are studied. In particular, the variances of the in-phase and quadrature components of the wave fluctuation are presented taking into account the beam width of the transmitter and receiver and the scattering and absorption characteristics of a single-particle. Expressions for the temporal frequency spectra of the in-phase and quadrature components are formulated taking into account the terminal velocities of the rain drops. Author

N73-26123 Politecnico di Milano (Italy). Inst. di Elettrotecnica ed Elettronica.
DEPOLARIZATION OF AN ELECTROMAGNETIC WAVE TRAVELING THROUGH A STRATIFIED AEROSOL ON NONSPHERICAL SCATTERING
C. Capsoni and A. Paraboni *In its* Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 16 p refs (For availability see N73-26121 17-07)

Propagation through an aerosol of non-spherical scatters having transverse stationary statistic distribution is studied by making use of the equivalence to a stratified homogeneous medium with suitable electric characteristics. Relationships between the degree of depolarization for linearly and circularly polarized waves, the differential propagation and the physical parameters of the medium are determined. Author

N73-26124 Fengler (C.), Hamburg (West Germany).
THE PHASE OF A PLANE ELECTROMAGNETIC WAVE TRANSMITTING WIDE SPREAD ATMOSPHERIC DISCONTINUITY
C. Fengler *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 8 p refs (For availability see N73-26121 17-07)

For the estimation of multipath progation and phase delay effects the fundamental processes of refraction and reflection at wide-spread atmospheric discontinuities are treated with the aid of an asymmetrical and a symmetrical Epstein profile. The reflection against an asymmetrical profile as well as the transition through a non-ionized and an ionized layer of symmetrical profile are considered. In particular the phase of the corresponding index of reflection and transmission is evaluated in point of view of frequencies from 10 to 100 GHz and the dimensions of atmospheric inhomogeneities. The treatment shows that at the mentioned propagation processes the phase of the incident wave can vary remarkably; it shows herewith a sensitive dependence on the fluctuating parameters of the atmospheric structure.
Author

N73-26125 Hamburg Univ. (West Germany).
PHASE MEASUREMENTS WITH MICROWAVES NEAR THE SEA SURFACE
H. W. Fruechtenicht *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 9 p refs (For availability see N73-26121 17-07)

Microwave propagation over sea within the horizon may be treated by ray tracing. The resultant phase of the interference field, which is set up in front of the transmitter, depends on the refractivity N sub 1 on a fixed but arbitrary reference level and on the thickness of the maritime evaporation duct. Between the phase and N sub 1 there exists a linear relationship. As a function of duct thickness, however, the phase reveals a discontinuity amounting to integer multiples of 2 pi but at least 2 pi. Therefore, phase measurements near the sea surface may be many valued.
Author

N73-26126* Institute for Telecommunication Sciences, Boulder, Colo. Office of Telecommunications.
ATTENUATION AND PHASE DISPERSION IN THE ATMOSPHERE DUE TO THE MICROWAVE SPECTRUM OF OXYGEN
H. J. Liebe and W. M. Welch *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 18 p refs Sponsored in part by NASA and NOAA (For availability see N73-26121 17-07)

Radio wave propagation in the 40- to 140-GHz band through the earth's atmosphere is strongly influenced by the behavior of the O2 microwave spectrum. This behavior causes the transfer function to depend critically upon altitude. The spectroscopic

properties of O2 are discussed and reduced to engineering formulas expressing attenuation and phase dispersion rates in terms of frequency and meteorological parameters. The theory is supported on several accounts by reliable spectroscopic measurements. Pressure scanning spectroscopy is used to investigate the O2 microwave spectrum under simulated atmospheric conditions. The application of spectroscopic information to analytical treatments of transfer properties for inhomogeneous slant paths is demonstrated. Attenuation and phase dispersion between 49 and 72 GHz are evaluated for zenith and tangential paths. Author

N73-26127 Bell Telephone Labs., Inc., Holmdel, N.J.
DEPOLARIZATION OF MICROWAVES IN TRANSMISSION THROUGH RAIN
D. C. Hogg *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 5 p refs (For availability see N73-26121 17-07)

Relationships are given for depolarization of linearly and circularly polarized microwaves propagating through rain. Computations using a simple model for the rain medium show that depolarization is more significant for circular than for linear polarization. Author

N73-26128 Bell Telephone Labs., Inc., Holmdel, N.J.
INTRODUCTION TO SESSION 2
D. C. Hogg *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 2 p refs (For availability see N73-26121 17-07)

The following measurements are required in engineering radio communication systems: (1) Attenuation as a function of path length and time: precipitation, atmospheric gases, spatial variations in refractivity, environment; (2) Bandwidth capability: delays within a band cause by the environment, scattering by precipitation, spatial variation in refractivity; (3) Depolarization: by the environment, precipitation, antennas; (4) Interference: caused by refractivity variations, scattering by precipitation, poor antenna quality, environment; and (5) Phase variations: refractivity changes, precipitation. Author

N73-26129 Fondazione Ugo Bordoni, Rome (Italy).
CRITERIA AND EXPECTED ACCURACY OF THE MEASUREMENTS ENVISAGED IN THE RESEARCH PROGRAMME UNDER WAY IN ITALY
F. Fedi *In* AGARD Telecommun. Aspects of Freq. Between 10 and 100 GHz Apr. 1973 23 p refs (For availability see N73-26121 17-07)

The research program on the free propagation of electromagnetic waves at frequencies higher than 10 GHz is outlined. The aims and criteria governing the approach to the program are discussed and an account is given of the radioelectrical and meteorological measurements to be made and the accuracy which may be expected, on the basis of the foreseeable causes of error and the results of preliminary tests already performed. Author

N73-26130 Louvain Univ. (Belgium). Microwave Lab.
EFFECTS DUE TO PRECIPITATION ON HORIZONTAL LINKS AT 12 AND 35 GHZ
A. VanderVorst and E. Gaudissart *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 6 p refs (For availability see N73-26121 17-07)

Two horizontal line-of-sight links have been installed at 11.7 and 35 GHz in cooperation with meteorological station. A balloon allows measurements to be made in the low atmosphere. The signals are emitted at the top of a tower, reflected back at the top of another building, and received at the location of the emitter. To avoid a coupling between the emitting and receiving antennas, the frequency of the emitted waves is modulated by an amount equal to the intermediate frequency, at a frequency determined by the length of the microwave path. An analog-to-digital conversion allows the data to be computerized: the results at 12 and 35 GHz are autocorrelated, cross-correlated with each other, and cross-correlated with the meteorological parameters. The correlation matrix is used to compute the mean-square regression of the propagation measurements on the meteorological measurements. Author

N73-26131 Mitre Corp., Bedford, Mass.
PROPAGATION OF 15.6 - 31.2 GHz AND 45 - 90 GHz COHERENT SIGNAL PAIRS
John F. Sullivan and Harold M. Richardson *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 11 p refs (For availability see N73-26121 17-07)

Two pairs of coherent signals have been transmitted through the atmosphere over a 23.1 km path well clear of terrain features. The lower pair of signals spanned 15.6 GHz and the upper pair spanned 45 GHz of the millimeter spectrum. There is no reason to believe that the entire band from 15 to 90 GHz could not be spanned coherently with appropriate apparatus. However, the entire band is not completely useful because of strong absorption near the oxygen absorption lines in the region of 60 GHz and strong temporal and spacially dependent attenuation in the presence of precipitation along the path. It is shown that atmospheric structure imposes commonly minor modulation on mm wave propagation over a limited bandwidth from near zero to a few Hz; this modulation increases with carrier frequency, path length, and intensity of turbulence which in turn varies widely from time to time. Within the limits of the available data, it is concluded that the theory of wave propagation perturbation by turbulent media is valid. Author

N73-26132 Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
IMPROVED DATA FOR PROPAGATION ANALYSIS
Gregers Mogensen *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 4 p refs (For availability see N73-26121 17-07)

In the planning for a new terrestrial propagation experiment it is found that the complex transfer function vs. frequency should be measured in a 1.5 GHz wide frequency range. This transfer function would give the most accurate and usable results since it is not directed towards any particular modulation scheme. Since it is not possible to construct a system for measuring the transfer function, a differential gain, differential phase measurement system is used. The necessary set of formulas to calculate from the measurement data the RF phase curve deviations from a straight line is established. The formulas are tested by numerical simulations and it is found possible to determine the RF phase curve with an accuracy of 1% relative to the peak-peak deviations of the phase curve. Author

N73-26133 Federal German Post Office, Darmstadt (West Germany). Research Inst. of the Telecommunication Engineering Center.
SOME OBSERVATIONS OF SCATTERING FROM RAIN ON A 12 GHz TRANS-HORIZON LINK
N. Abel *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 13 p refs (For availability see N73-26121 17-07)

A 12 GHz experimental transhorizon link of 210 km length was operated with an elevated receiving antenna beam which intersected the transmitting antenna beam over approximately the last quarter of the path. The possible scattering angles ranged around 4 degrees, the half power beam width of both antennae was 1.8 degrees. Rain scatter signals were observed via the main lobe of the receiving antenna without any significant restraint, whereas the permanent, but narrow angle turbulence scatter signals were received via side lobes and therefore, reduced to values most barely above threshold. With the aid of fading character and of weather observations, a statistical distribution of rain scatter transmission loss was isolated from the data. During the strongest rain scatter events, the transmission loss was up to 20 db lower than the average loss for turbulence scatter in this particular configuration. Transmission loss values estimated on the basis of rain gauge data seem to be consistent with the measured ones. Author

N73-26134 Norwegian Defence Research Establishment, Kjeller.
THE INFLUENCE OF PRECIPITATION AND MULTIPATH FADING ON FREQUENCIES BETWEEN 10 AND 18 GHz
Odd Gutteberg (Norwegian Telecommun. Admin. Res. Estab., Kjeller) and Anton G. Kjelaas *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 7 p refs (For availability see N73-26121 17-07)

Taken the very short measuring time into consideration, the measured attenuation due to rain fits very well the values obtained from rainfall rate in one point applying the reduction coefficient given by Battesti et al. Multipath fading due to atmospheric stratification (duct) has been observed usually during night with nocturnal radiation. The fading depths observed due to multipath are about 1/3 in db of those caused by rain. Author

N73-26135 McGill Univ., Montreal (Quebec). Dept. of Meteorology.
RAIN ATTENUATION STATISTICS FOR FREQUENCIES ABOVE 10 GHz FROM RAINGAUGE RECORDS
G. Drufuca *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 15 p refs (For availability see N73-26121 17-07)

Tipping bucket raingauge records have been used to generate statistics of rain attenuation at 11.2 GHz for a 5-mile microwave link. The knowledge of storm velocity measured by weather radar is used to transform records into profiles of rainfall rate versus distance. These profiles are then properly integrated over a 5-mile length obtaining simulated attenuation values. These are then compiled as probability curves. A comparison between the actual statistics of the link and the simulated statistics shows good agreement. Author

N73-26136 Radio and Space Research Station, Slough (England).
THE INFLUENCE OF RAINFALL ON LINE-OF-SIGHT PROPAGATION AT 110 GHz IN SE ENGLAND
D. T. Llewellyn-Jones and A. M. Zavody *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 6 p refs (For availability see N73-26121 17-07)

In the case of millimeter wave propagation through the atmosphere the problem exists of predicting link reliability on the basis of known rainfall data. This requires knowledge of the relationships between rainfall rate at one point and attenuation observed over a given path length. Various methods have been devised to provide more information on these problems at a frequency of 110 GHz. This work involves the use of raingauges and spatially separated propagation links. Some results are described, and it is seen that frequencies as high as 110 GHz have potential practical applications over line-of-sight paths of the order of 3 km length. Predicted reliabilities for some applications can be comparable to those obtained at frequencies near 30 GHz. Author

N73-26137 Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
EXTRAPOLATION OF PROPAGATION DATA
P. Gudmandsen *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 2 p refs (For availability see N73-26121 17-07)

A short description is given of a plan to use field strength recordings on one path for prediction of the performance of another path with somewhat different weather conditions based on weather data recorded simultaneously. The influence of rain on the performance of communication links at frequencies in the range 10 - 18 GHz is considered. Author

N73-26138 Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
EXPERIMENTAL METHOD OF MEASURING PROPAGATION ATTENUATION OF RAIN [METHODE EXPERIMENTALE DE MESURE DE L'AFFAIBLISSEMENT DE PROPAGATION DU A LA PLUIE]
P. Misme, L. Boithias, and J. Battesti *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 6 p ref In FRENCH (For availability see N73-26121 17-07)

After having given a theoretical definition of equivalent precipitation intensity, it is pointed out how this quantity may be calculated experimentally with the help of propagation results. The value of a reduction coefficient, function of the length of a connection and percentage of time are described. Consequently, with the help of experimental results, a method is developed that permits calculation of absorption as a product of rain for a percentage of any time and for all frequencies less than frequencies in the vicinity of 30 GHz and distances less than about 20 kilometers. Author

N73-26139 Communications Research Centre, Ottawa (Ontario).
AMPLITUDE FADING OF SATELLITE COMMUNICATIONS SIGNALS AT SHF
K. S. McCormick, R. L. Olsen, and L. A. Maynard *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 8 p refs (For availability see N73-26121 17-07)

For SHF satellite communications systems designed to operate at elevation angles less than several degrees, allowance must be made for fluctuations in the signal level caused by variations in the refractive structure of the troposphere. As part of a program to investigate these effects, the signals from satellite beacons at 7.3 GHz have been monitored during several periods over the last five years. The results show that in the summer months, the fading is greater than 10 db for 0.1% of the time at elevation angles below three degrees, while, for the winter months, fades greater than 6 db occur under the same conditions. A limited series of observations at resolute (latitude 75 N) show that in the Arctic, the fading in the summer is similar to that which occurs in Ottawa in the winter. Author

N73-26140 Radio and Space Research Station, Slough (England).
SLANT PATH ATTENUATION AT FREQUENCIES ABOVE 10 GHz
P. G. Davies *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 11 p refs (For availability see N73-26121 17-07)

Results obtained from solar tracking radiometer measurements made at 19 GHz and at 37 GHz have been studied to give data on attenuation (primarily caused by rain) on paths through the troposphere. Such information is required in the planning and operation of microwave links to and from satellites. The results are presented in statistical form as cumulative distributions of the percentage of the observation time for which the attenuation exceeds various values. Analysis of individual fades exceeding 5 and 10 db at both 19 and 37 GHz has also been carried out and the results are presented as histograms showing the number of fades as a function of fade duration. Author

N73-26141 Texas Univ., Austin. Electrical Engineering Research Lab.
STATISTICS ON EARTH SATELLITE ATTENUATION AT TWO TEXAS LOCATIONS
A. W. Straiton, David N. Pate, and Bob M. Fannin *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 9 p refs (For availability see N73-26121 17-07)

Propagation experiments using the 15.3 GHz transmitter on the ATS-5 satellite as a signal source are reported. Signal strength data were recorded at two locations: at Austin in central Texas for twenty months and at Mount Locke in far west Texas for five weeks. The elevation angle in each case was near 54 deg. It is concluded that for high elevation angles severe attenuation is almost always associated with thunderstorms. Curves of percentage of time versus path attenuation for an average year are given for both sites. The height of the top of the thunderstorm cloud was found to be a fairly good single indicator of the intensity and duration of fades. Author

N73-26142 Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
COMPARISON OF DIRECT AND INDIRECT MEASUREMENTS OF PRECIPITATION ATTENUATION AT 15.3 GHz
J. I. Strickland *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 8 p refs (For availability see N73-26121 17-07)

The signal strength received at 15.3 GHz from the ATS-5 satellite was measured using a 9 metre antenna. The receiving antenna is also connected as a total-power radiometer, providing simultaneous measurements of the sky noise temperature at 15.3 CHz with an antenna beamwidth of 0.15 degrees. Attenuations, calculated from the measured sky temperatures, show very good agreement with the directly measured attenuations. Author

N73-26143 Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
SPACE COMMUNICATIONS SYSTEMS CONSIDERATIONS

AT 94 GHz
H. J. Wintroub and L. A. Hoffman *In* AGARD Telecommun. Aspects on Freq. Between 10 and 100 GHz Apr. 1973 17 p refs (For availability see N73-26121 17-07)

The effects of atmospheric physical phenomena in determining satellite-ground radio link performance are considered. Experimental data are presented as a basis for the determination of link margins and tradeoffs between communication capacity and outage because of rain-induced attenuation or high atmospheric turbulence. State-of-the-art and predicted performance of future millimeter wave components are considered in formulating the spacecraft and ground terminal systems. Included are a beam swinging experiment using a precision controlled 4.57-m antenna to obtain data on wavefront tilt fluctuations, time histories of amplitude scintillation for 0.15-, 0.61-, and 4.57-m apertures, and statistical data on water vapor attenuation. Author

N73-26144*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VEHICLE LOCATING SYSTEM UTILIZING AM BROADCASTING STATION CARRIERS Patent Application
George R. Hansen, Jr., inventor (to NASA) Filed 21 May 1973 40 p
(Contract NAS7-100)
(NASA-Case-NPO-13217-1; US-Patent-Appl-SN-362145) Avail: NTIS HC $4.00 CSCL 17B

A radio system which permits a central station to monitor the geographic position of vehicles in a metropolitan area using unsynchronized commercial AM broadcasting stations to form hyperbolic isophase grid lines is described. The equipment required in the vehicles and the method of operation are described. A diagram of the circuits in the transmitter receiver and an example of the hyperbolic location grid are provided. NASA

N73-26145*# TRW Systems Group, Redondo Beach, Calif.
SPECTRAL ANALYSIS PROGRAM. VOLUME 1: USER'S GUIDE
W. L. Hayden 12 Jun. 1972 68 p refs
(Contract NAS9-11977)
(NASA-CR-128984; TRW-20817-H010-R0-00-Vol-1) Avail: NTIS HC $5.50 CSCL 20N

The spectral analysis program (SAP) was developed to provide the Manned Spacecraft Center with the capability of computing the power spectrum of a phase or frequency modulated high frequency carrier wave. Previous power spectrum computational techniques were restricted to relatively simple modulating signals because of excessive computational time, even on a high speed digital computer. The present technique uses the recently developed extended fast Fourier transform and represents a generalized approach for simple and complex modulating signals. The present technique is especially convenient for implementation of a variety of low-pass filters for the modulating signal and bandpass filters for the modulated signal. Author

N73-26146*# TRW Systems Group, Redondo Beach, Calif.
SPECTRAL ANALYSIS PROGRAM (SAP). VOLUME 2: PROGRAMMER'S MANUAL
G. L. Houser and R. C. Thomas 16 Jun. 1972 160 p refs
(Contract NAS9-11977)
(NASA-CR-128985; TRW-20817-H011-R0-00-Vol-2) Avail: NTIS HC $10.00 CSCL 20N

The spectral analysis program (SAP) flow diagrams, and listings are presented. The plot generation program (PLTGEN) flow diagrams and listings are also included. Author

N73-26147# Royal Aircraft Establishment, Farnborough (England).
A THEORETICAL AND EXPERIMENTAL EXAMINATION OF THE BEHAVIOUR OF COAXIAL CABLES WITH WOVEN OUTER CONDUCTORS IN THE PROPAGATION OF ELECTROMAGNETIC WAVES
S. Dijkhuizen Nov. 1972 34 p refs Transl. into ENGLISH from a Dutch report
(RAE-Lib-Trans-1642; BR32802) Avail: NTIS HC $3.75 CSCL 20N

The performance of a cable braid is judged on the basis of its contribution to the total attenuation of the cable and by its screening efficacy. A series of braids were specially made having a range of lay angles and coverage factors. Measurements were made of their radio-frequency attenuation and screening efficacy. An unexpected conclusion is that the attenuation of cables with high coverage braids do not have such low attenuation as similar cables having a lower coverage. Maxwell's equations are applied to the field structure within and outside a coaxial pair. Author

N73-26148*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ERROR ANALYSIS FOR MARINER VENUS/MERCURY 1973 CONDUCTED AT THE JPL MESA WEST ANTENNA RANGE
N. L. Vincent, C. A. Smith, A. J. Brejcha, and H. A. Curtis 1 Jun. 1973 41 p ref
(Contract NAS7-100)
(NASA-CR-133230; JPL-TM-33-625) Avail: NTIS HC $4.25 CSCL 17B

Theoretical analysis and experimental data are combined to yield the errors to be used with antenna gain, antenna patterns, and RF cable insertion loss measurements for the Mariner Venus-Mercury 1973 Flight Project. These errors apply to measurements conducted at the JPL Mesa, West Antenna Range, on the high gain antenna, low gain antenna, and RF coaxial cables. Author

N73-26149# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PHYSICAL PICTURE FOR THE ANOMALOUS PROPAGATION OF ORDINARY ELECTROMAGNETIC WAVES IN A PLASMA
B. D. Fried Jun. 1972 12 p refs
(IPPJ-130) Avail: AEC Depository Libraries

It is shown that the physical mechanism for the anomalous propagation of electromagnetic waves at frequencies below the plasma frequency is due to the deflection of particles thermal motion by the wave magnetic field, leading to a density perturbation that can be large when enhanced by some resonance. In presence of an external magnetic field, cyclotron resonance provides the enhancement for ordinary waves. A wave-particle resonance can occur, again giving rise to anomalous propagation, if the velocity distribution is anisotropic with respect to the wave vector, which allows slow electromagnetic waves, with phase velocity less than the velocity of light. The Weibel instability, which also occurs with such a distribution function, relies upon the same physical mechanism. Author (NSA)

N73-26150# Lockheed Missiles and Space Co., Palo Alto, Calif.
TRACKING DISRUPTION IN QUASI-STATIONARY SYSTEMS
G. V. Obrezkov and V. D. Razevig [1973] 38 p Transl. into ENGLISH from the book "Metody Analiza Sryva Slezhenii" Sovetskoe Radio, Moscow, 1972
Avail: NTIS HC $4.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Quasi-stationary tracking systems in which all the transients have succeeded in being completed up to the time of the beginning of observation are analyzed for their dynamic tracking error constant throughout the tracking mode. Disruption of tracking is considered as the emergence of the tracking error outside the limits of some fixed levels associated with the aperture of the discrimination characteristic. The frequency of disruptions in nonlinear systems is calculated by using methods of Markov random process theory. G.G.

N73-26151# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON AN ESTIMATE OF THE ACCURACY OF A METHOD OF SYNTHESIZING FILTERS OPTIMIZING THE MUTUAL UNCERTAINTY FUNCTION IN THE MINIMAX CRITERION
Iu. I. Abramovich [1973] 4 p refs Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), v. 18, no. 5, 1973 p 1066-1068
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The synthesis of micron filters for optimizing the mutual uncertainty function in the maximum criterion is considered for real signals and filters when the zone of suppression includes only the side lobes. An approximate method is used to max-

imize the main peak of the mutual uncertainty function that replaces the constraint imposed on the modulus of the complex side lobes in the suppression zone by constraints imposed on the moduli of the real and imaginary parts of the complex side lobe. This replacement of the constraints permits linear programming. G.G.

N73-26152*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
HIGH POWER MICROWAVE COMPONENTS FOR SPACE COMMUNICATIONS SATELLITE
H. Jankowski and A. Geia Feb. 1972 187 p refs
(Contract NAS3-13727)
(NASA-CR-120927) Avail: NTIS HC $11.50 CSCL 17B

Analyzed, developed, and tested were high power microwave components for communications satellites systems. Included were waveguide and flange configurations with venting, a harmonic filter, forward and reverse power monitors, electrical fault sensors, and a diplexer for two channel simultaneous transmission. The assembly of 8.36 GHz components was bench tested, and then operated for 60 hours at 3.5 kW CW in a high vacuum. The diplexer was omitted from this test pending a modification of its end irises. An RF leakage test showed only that care is required at flange junctions; all other components were RF tight. Designs were extrapolated for 12 GHz and 2.64 GHz high power satellite systems. Author

N73-26153*# Scripta Technica, Inc., Washington, D.C.
MICROWAVE RADIATION CHARACTERISTICS OF DRY AND MOIST GROUND COVERS
A. E. Basharinov NASA Jul. 1973 10 p refs Transl. into ENGLISH from "SVCH Radyatsyinnye Kharakteristiki i Vlazhnykh Materikovykh Pokrovov" Moscow, 1973 11 p Presented at the meeting of the Soviet-American Working Group on Remote Sensing of Natural Environment from Space, 12-17 Feb. 1973
(Contract NASw-2484)
(NASA-TT-F-14975) Avail: NTIS HC $3.00 CSCL 20N

Various uses and applications of spaceborne microwave measurements are given. Such measurements can be used to detect fires, measure soil moisture and temperature, measure sub-ice soil temperatures and the thickness of ice cover, as well as in the search for subsurface water. Author

N73-26154# Royal Aircraft Establishment, Farnborough (England).
INTERSHEATHS BETWEEN CABLE BRAIDS
W. T. Blackband Sep. 1972 14 p
(RAE-TR-72151; BR31561) Avail: NTIS HC $3.00

The screening efficacy of a double braided cable can be improved by thickening the insulating intersheath between the braids and by reducting its dielectric constant. Improvement also accompanies an increase in the power factor of the intersheath, however, this is only significant at the higher radio frequencies. The importance of the radial thickness of the intersheath being uniform around the circumference in order that the two braids be concentric is shown. Author (ESRO)

N73-26155# Royal Aircraft Establishment, Farnborough (England).
A THEORY OF ELECTRICAL CONDUCTION IN WIRE BRAIDS
W. T. Blackband Oct. 1972 21 p refs
(RAE-TR-72153) Avail: NTIS HC $3.25

A theory is derived in order to account for the losses in wire braid coaxial conductors in the frequency band where skin effect is not important and in the band where it is well developed. As the theory assumes that there is no current transfer across the wire contacts, it would not be applicable in the microwave band without some modification. Author (ESRO)

N73-26156# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
SHORT HELICAL ANTENNAS WITH EXACT CIRCULAR POLARIZATION BEHAVIOR BY A CONDUCTING DISC AT THE END OF THE HELIX Ph.D. Thesis - Brunswick Univ. [KURZE WENDELANTENNEN MIT EXAKT ZIRKULAREM POLARISATIONSVERHALTEN DURCH EINE LEITSCHEIBE AM WENDELENDE]
Helmut Bothe 5 Feb. 1973 91 p refs In GERMAN; ENGLISH summary
(DLR-FB-73-46) Avail: NTIS HC $6.75; DFCLR, Porz: 18 DM

The polarization behavior of axial mode short helicial antennas with a number of turns smaller than 2 was investigated through theory and experiment. Exact circular polarization was achieved by arranging a conducting disc at the free end of the helix. The influence of the disc on polarization was demonstrated by measuring the current distribution on the helix conductor, calculating the resulting polarization behavior, and measuring the far field polarization. Author (ESRO)

N73-26157# AEG-Telefunken, Ulm (West Germany).
DEFINITION STUDY FOR TDMA/PSK TEST EQUIPMENT FOR THE MODULAR REPEATER. VOLUME 1: TECHNICAL PART Final Report
[1972] 184 p ref
(Contract ESTEC-1588/72-SW)
(ESRO-CR(P)-144) Avail: NTIS HC $11.25

The operation of the test equipment for a modular repeater is summarized. This includes the types of signals and transmission system. The specifications and description of the test equipment are then given with emphasis placed on the TDMA-signal generation, PSK modulator, up-converter, test converter, down converter, and error measuring unit. Finally the channel shaping filter is described. ESRO

N73-26158# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
INTERROGATOR SETS Final Report
4 Aug. 1972 16 p refs
(AD-759227; TOP-6-3-150) Avail: NTIS CSCL 17/9

The report describes a method for evaluation of interrogator set operational and functional performance characteristics and identifies supporting tests, facilities, and equipment required. (Author Modified Abstract) GRA

N73-26159# Naval Research Lab., Washington, D.C.
THE ROLE OF THE ANTENNA IN RADAR
Merrill I. Skolnik Apr. 1973 64 p
(AD-759693; NRL-MR-2574) Avail: NTIS CSCL 17/9

The antenna is a characteristic part of a radar system and has much influence on radar design. The report describes the role played by the antenna from the viewpoint of the radar systems engineer. It is shown what effect the antenna gain and aperture have when the radar is limited by thermal noise, clutter, or jamming in situations when the radar is either searchlighting or scanning. In some applications, the gain is the chief factor of importance, in others it is the aperture or the gain-aperture product. In some cases the antenna is of no significant importance at all, other than there be one. The properties of antennas are reviewed, and their significance to radar application is discussed. (Author Modified Abstract) GRA

N73-26160# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INCREASE IN SIDELOBE LEVEL CAUSED BY WATER DROPS ON AN ANTENNA'S RADOME
Leon J. Ricardi 3 Jan. 1973 26 p refs
(Contract F19628-73-C-0002; AF Proj. 1508A)
(AD-759178; TN-1973-3; ESD-TR-73-52) Avail: NTIS CSCL 17/9

The radome enclosing an antenna serves the primary purpose of providing a controlled environment for the antenna. Unfortunately, the accumulation of rain on the outer surface of the radome deteriorates the performance of the antenna. This technical note computes the expected increase in sidelobe level and reduction in gain assuming that spherical drops of water are located randomly on the surface of the radome. Author (GRA)

N73-26161# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
ADVANCED CONCEPTS OF MICROWAVE GENERATION AND CONTROL IN SOLIDS Quarterly Interim Report, 1 Oct. - 31 Dec. 1972
G. C. Dalman, L. F. Eastman, C. A. Lee, J. Frey, and R. H. Chilton Mar. 1973 103 p refs
(Contract F30602-71-C-0110)

(AD-759542; RADC-TR-73-78; QIR-9) Avail: NTIS CSCL 09/1

The report deals with the progress made during the ninth quarterly period of a solid state microwave oscillator and amplifier research and development program. The first section deals with the development of a PCM Gunn oscillator and the growth and evaluation of InP materials for LSA oscillators. Reviewed in the second section are high power TRAPATT diode structures, research on GaAs Schottky barrier avalanche diodes, research on high frequency TRAPATT oscillators, research on BARITT diodes, microwave transistor studies, and amplifier studies. The final section of the report deals with the progress made on ion implantation and diffusion, on vacuum epitaxial growth in silicon, on ionization rates in GaAs, and on a microwave monolithic integrated circuit study. (Author Modified Abstract) GRA

N73-26162# Naval Research Lab., Washington, D.C.

ANGULAR RESOLUTION OF TWO TARGETS IN A PULSED SEARCH RADAR Interim Report

James H. Hughen 30 Mar. 1973 24 p refs

(RF12151403)

(AD-759350; NRL-7551) Avail: NTIS CSCL 17/9

A generalized likelihood ratio test is used to find approximate limits on the angular resolution of two targets for a mechanically rotated antenna. The accuracy of maximum-likelihood azimuth estimates of the two interfering targets is also investigated. The results are found to be comparable to those obtained by directly processing the outputs of the individual elements of an antenna array. A simple ad hoc procedure for angular resolution and estimation is also analyzed. The performance of the ad hoc test is found to be within 2 to 3 db of that of the generalized likelihood ratio test. Author (GRA)

N73-26163# Naval Ordnance Lab., White Oak, Md.

SCATTERING OF ELECTROMAGNETIC RADIATION BY APERTURES. 6: FIRST DISCUSSIONS ON GENERALIZING BABINET'S PRINCIPLE IN TWO DIMENSIONS

Michael P. Fry and Louis F. Libelo 6 Mar. 1973 21 p refs

(AD-759690; NOLTR-73-43) Avail: NTIS CSCL 20/14

The authors present in the report efforts to thoroughly understand Babinet's principle for electromagnetic diffraction and the results of the initial efforts to extend the principle beyond its usual range of application. Proof is given that the principle in its present form is invalid for general two dimensional, infinitely thin, perfectly conducting surfaces containing apertures. The only case in which it is valid is the conventional one of an infinite plane. Author (GRA)

N73-26164# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

MEASUREMENTS OF WIND-INDUCED DOPPLER SHIFTS AT 16 GHz OVER A LONG RANGE BISTATIC SCATTER LINK

R. L. Olsen (Comm. Res. Centre, Ontario) and U. H. W. Lammers 30 Apr. 1973 8 p refs Presented at IEE Conf. on Propagation of Radio Waves at Freq. above 10 GHz, London, 10-13 Apr. 1973

(AF Proj. 8682)

(AD-760119; AFCRL-TR-73-0246) Avail: NTIS CSCL 20/14

The paper describes the use of Doppler shift measurements made with a narrow-beam forward scatter system operating at 16 GHz over a 500 km trans-horizon path to estimate average wind speeds in the upper troposphere. Estimated of average crosspath wind speeds are shown to compare favourably with corresponding radiosonde measurements. In contrast with the more limited capability of a radiosonde, a scatter system can rapidly map average crosspath and vertical wind speeds over large regions of the troposphere. The effect of certain abnormal propagation conditions on the ability to obtain average wind speeds from Doppler shift measurements is also demonstrated. Author (GRA)

N73-26165# Hughes Aircraft Co., Culver City, Calif. Antenna Dept.

RADIATION FROM SLOT-FED DIELECTRIC SLABS

Alfred T. Villeneuve Dec. 1972 59 p refs

(Contract F19628-72-C-0145; AF Proj. 4600)

(AD-760129; HAC-Ref-C5350; Rept-2765.31/420; AFCRL-TR-73-0088) Avail: NTIS CSCL 09/5

The report contains analyses of the radiation characteristics of grounded dielectric slabs fed by slots in the groundplane. Two configurations are examined, one in which a semi-infinite slab covers the slot, a second in which a finite slab does not extend over the slot. The slots are parallel to the slab edges so that only TM mode propagation is considered. Integral equations are derived for the fields at the ends of the slabs and approximate solutions are obtained. Numerical results in the form of radiation patterns are given for the case of the semi-infinite slab. It is found that the feed pattern is very close to the space-wave that would exist if the slab were infinite, but differs from it in the region near the horizon. The results can be applied to studies of electronic scanning of finite arrays of slots in the presence of surface wave structures. Recommendations for further study are included. Author (GRA)

N73-26166# Colorado Univ., Boulder.

ADAPTIVE ARRAY PROCESSING OF HF SIGNALS PROPAGATED OVER A 2600 KM PATH Final Report, 1 Jan. - 31 Dec. 1972

Lloyd J. Griffiths and Michael J. Larimore 1 Jan. 1973 124 p refs

(Contract F30602-72-C-0386; ARPA Order 1423)

(AD-760137; RADC-TR-73-75) Avail: NTIS CSCL 17/2

The purpose of the study was to investigate the potential advantages which may accrue to HF antenna array systems by employing adaptive beamforming techniques. Data for the study were obtained using a CW transmitter located in Bearden, Arkansas and an eight element, narrow band (31.25 Hz) receiving array in Los Banos, California. The Bearden signal was presumed to be an undesired interference. The individual array element signals were combined using tapped-delay-line filters for purposes of rejecting the Bearden signal while simultaneously forming a beam in the direction of a weak desired signal. It was shown that adaptive adjustment of the delay line weights provided better than 25 db improvement over conventional beamforming methods. The adaptive time constant was measured as 27,000 adaptations for each 3 db improvement, corresponding to a real time rate of less than 100 msec for special purpose digital hardware. Author (GRA)

N73-26167# California Univ., Los Angeles. School of Engineering and Applied Science.

NUMERICAL STUDY OF MINIMUM PROBABILITY OF ERROR EXPRESSION IN A DIGITAL COMMUNICATION SYSTEM WITH INTERSYMBOL INTERFERENCE

James Warren Collier Jan. 1973 49 p refs

(Contract N00014-69-A-0200-4043; NR Proj. 042-285)

(AD-760057; UCLA-ENG-7327; TR-1) Avail: NTIS CSCL 09/4

The report describes the application of an iterative method for solving a set of simultaneous non-linear equations which minimizes the probability of error in a digital communication system with intersymbol interference. The form of the optimum linear receiver for such a system as well as the equations to be solved are described in detail in the introduction. The equations are approximated by a numerical quadrature formula. In the following section, an iterative method for the solution of the approximating equations is described. The equations are put into a suitable form for applying the method; a starting value is given. The third section consists of an APL computer program which uses the method and a program description. In the last section, the technique is illustrated with four examples with varying degrees of intersymbol interference. The probability of error for the optimum linear receiver is plotted as a function of signal to noise ratio of the desired signal. The appendix contains a brief discussion of the error incurred in using the quadrature formula. Author (GRA)

N73-26168# Computer Sciences Corp., Falls Church, Va.

ERROR PROTECTION MANUAL (WITH SUMMARY AND SUPPLEMENT) Final Report, 31 Mar. - 30 Nov. 1972

Paul J. Trafton 1 Apr. 1973 570 p refs

(Contract F30602-72-C-0354; AF Proj. R109)

(AD-759836; CSC-4358-00; AFCS-TR-73-1) Avail: NTIS CSCL 09/4

The manual presents a tutorial discussion of error protection

techniques for data communications. Chapter 1 presents an introduction to information theory and, in particular, the noiseless and noisy coding theorems discovered by Shannon. Chapter 2 presents a survey of basic modulation/demodulation techniques. Chapter 3 discusses the physical error producing mechanisms of communication channels and the limitations of various media to the transmission of data. Chapter 4 surveys the major classes of error control techniques and discusses numerous specific error control codes. Chapter 5 considers the timing and synchronization problems that must be considered when error control coding is introduced into a system, e.g., the problem of obtaining codeword synchronization with block codes. Chapter 6 presents a survey of published performance results for various error control techniques and outlines a coding selection methodology. Chapter 7 gives an historical survey of error control coding and a state-of-the-art summary of error control. Finally, a glossary of the important terms encountered in the field of error protection is given. GRA

N73-26169# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
EXTENDING THE ERROR CORRECTION CAPABILITY OF LINEAR CODES
Ashok D. Ingle and Daniel P. Siewiorek Mar. 1973 16 p ref
(Contract F44620-70-C-0107; AF Proj. 9769)
(AD-760154; AFOSR-73-0743TR) Avail: NTIS CSCL 09/4

Linear transmission codes were developed under the assumption that the bit errors are independent and random. When these codes are applied to digital circuits, this assumption no longer holds. Using the past history of the bit failures, a linear transmission code that can detect k bit failures can be made to tolerate and correct up to (k-1) bit failures. Thus if the classical error correction bounds are assumed, a linear transmission code used in digital circuitry is under-utilized. For example, the single-error-correction, double-error-detection Hamming code could be used to correct up to two bit failures with some additional error correction circuitry. A simple algorithm for correcting these extra errors in linear codes is presented. Author (GRA)

N73-26170# Naval Ordnance Lab., White Oak, Md.
THRESHOLD DAMAGE IN RADOME MATERIALS BY DISCRETE WATER IMPACT BALLISTICS RANGE INVESTIGATION
John L. Lankford, Robert A. Leverance, and Socrates A. Longas 13 Feb. 1973 40 p refs
(ORD Proj. 035)
(AD-759973; NOLTR-73-34) Avail: NTIS CSCL 17/9

Techniques have been developed in the Naval Ordnance Laboratory (NOL) Aerophysics Ballistics Range for impacting test specimens with discrete liquid and solid particles. The specimens were nondestructively captured for detailed examination. Definite and repeatable thresholds of damage have been observed in slip-cast fuzed silica and other materials with variation in velocity of impact and drop size. The results of this program indicate the continuing need for controlled discrete impact data of this type to supplement erosion data and to characterize damage in new materials. Results are presented for drop sizes of approximately 1mm and 2mm for a range of velocities from subsonic to 4,000 feet per second. Author (GRA)

N73-26171# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
RESEARCH ON THE ESTIMATION OF TRAJECTORIE FROM RADAR DATA Final Report, 1 May 1971 - 30 Jun. 1972
Raymond S. Berkowitz, M. Plotkin, D. B. Luber, S. Gottesman, and T. Rabkin Apr. 1973 150 p
(Contract DAAB07-71-C-0212; DA Proj. 1S6-63719-DK-72; Proj. Ratran)
(AD-759947; Rept-73-02; ECOM-0212-F-71) Avail: NTIS CSCL 19/4

The purpose of the work reported was the development and evaluation of optimal algorithms for processing radar data for the estimation of characteristics and trajectory parameters of a class of bodies moving at high velocities through the air. In this final report, work reported in the three quarterly progress reports is summarized, the formulations finally adopted are described, and the numerical results obtained are displayed and evaluated. (Author Modified Abstract) GRA

N73-26172# Pacific Missile Range, Point Mugu, Calif.
N-STATION CREDIBILITY GAP
L. L. Goertzen 29 Dec. 1972 25 p refs
(AD-759975; PMR-TP-72-8) Avail: NTIS CSCL 17/9

The report presents a mathematical method for testing the hypothesis that N-stations are tracking the same object. This test suggests a scheme for editing and smoothing the data used in N-station solution tracking techniques. The assumptions are that: (1) The tracking of each station is independent of the tracking of any other station. (2) The probability density function for each station is gaussian. The probability density function for the block of data from N-station is determined by taking the product of the probability functions of each station. The confidence interval with the associated probability used to test the hypothesis is obtained using this block probability density function. Plots and a list showing confidence interval versus probability for gaussian probability functions of dimensions from 1 to 40 are included. Author (GRA)

N73-26173# Army Electronics Command, Fort Monmouth, N.J.
DEVELOPMENT OF CAMOUFLAGED BODY COUPLED RADIO TRANSMITTERS
K. Ikrath, K. J. Murphy, and W. Kennebeck Apr. 1973 31 p refs
(DA Proj. 1S6-62701-A-448)
(AD-759927; ECOM-4104) Avail: NTIS CSCL 17/2

Design, operation and performance of an experimental camouflage body coupled radio transmitter are described. The radiation mechanisms are elucidated by the results of signal transmission experiments in different local environments and in relation to radiation from a conventional whip antenna. Corresponding implications with regard to radio communications in open terrain, dense vegetation and urban environments are discussed. Author (GRA)

N73-26174# Cincinnati Electronics Corp., Ohio.
RADIO SET AN/PRC-70() Quarterly Report, 1 Oct. 1972 - 1 Jan. 1973
C. A. Bucher Apr. 1973 23 p
(Contract DAAB07-71-C-0319; DA Proj. 1S6-674701-D-535-01)
(AD-759953; ECOM-0319-6-71; Rept-80045-PRC-38/273; QR-6) Avail: NTIS CSCL 17/2

The report covers the development work on the AN/PRC-70 Radio Set for manpack usage. Primary effort was focused on initial testing of the AN/PRC-70 on a subsystem basis. The two major areas of testing concerned the Receiver/Exciter and the PA/Coupler. Other effort was concentrated on module release and mechanical updating. (Author Modified Abstract) GRA

N73-26373* Translation Consultants, Ltd., Arlington, Va.
THE EFFECT OF MOUNTAIN BARRIERS IN THE PATH OF METEOR PROPAGATION OF RADIO WAVES
N. N. Kalinina *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 73-80 ref (For availability see N73-26363 17-13)
CSCL 20N

N73-26400 Grenoble Univ. (France).
ESTIMATION OF A SPECTRAL DENSITY [ESTIMATION D'UNE DENSITE SPECTRALE]
D. Baudois *In its* Conjugate Points 5 Apr. 1973 p 35-39 In FRENCH (For availability see N73-26395 17-13)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-26175* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COUNTING DIGITAL FILTERS Patent
Shalhov Zohar, inventor (to NASA) Issued 8 May 1973 18 p Filed 20 Mar. 1972 Supersedes N72-25222 (10 - 16, p 2128)

Sponsored by NASA
(NASA-Case-NPO-11821-1; US-Patent-3,732,409; US-Patent-Appl-SN-236285; US-Patent-Class-235-164; US-Patent-Class-328-167; US-Patent-Class-235-152) Avail: US Patent Office CSCL 09B

Several embodiments of a counting digital filter of the non-recursive type are disclosed. In each embodiment two registers, at least one of which is a shift register, are included. The shift register received j sub x-bit data input words bit by bit. The kth data word is represented by the integer.
Official Gazette of the U.S. Patent Office

N73-26176* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMATED ATTENDANCE ACCOUNTING SYSTEM Patent
Carl P. Chapman, inventor (to NASA) Issued 19 Jun. 1973 16 p Filed 16 Jun. 1971 Supersedes N71-34189 (09 - 21, p 3534) Sponsored by NASA
(NASA-Case-NPO-11456; US-Patent-3,740,725; US-Patent-Appl-SN-153543; US-Patent-Class-340-172.5) Avail: US Patent Office CSCL 09B

An automated accounting system useful for applying data to a computer from any or all of a multiplicity of data terminals is disclosed. The system essentially includes a preselected number of data terminals which are each adapted to convert data words of decimal form to another form, i.e., binary, usable with the computer. Each data terminal may take the form of a keyboard unit having a number of depressable buttons or switches corresponding to selected data digits and/or function digits. A bank of data buffers, one of which is associated with each data terminal, is provided as a temporary storage. Data from the terminals is applied to the data buffers on a digit by digit basis for transfer via a multiplexer to the computer.
Official Gazette of the U.S. Patent Office

N73-26177*# Texas A&M Univ., College Station.
NASA AUTOMATIC SYSTEM FOR COMPUTER PROGRAM DOCUMENTATION, VOLUME 2 Final Report
D. Simmons Dec. 1972 309 p 2 Vol.
(Contract NAS5-11911)
(NASA-CR-132752) Avail: NTIS HC $17.50 CSCL 09B

The DYNASOR 2 program is used for the dynamic nonlinear analysis of shells of revolution. The equations of motion of the shell are solved using Houbolt's numerical procedure. The displacements and stress resultants are determined for both symmetrical and asymmetrical loading conditions. Asymmetrical dynamic buckling can be investigated. Solutions can be obtained for highly nonlinear problems utilizing as many as five of the harmonics generated by SAMMSOR program. A restart capability allows the user to restart the program at a specified time. For Vol. 1, see N73-22129. Author

N73-26178*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DIFFERENTIAL MANEUVERING SIMULATOR DATA REDUCTION AND ANALYSIS SOFTWARE
Gary P. Beasley and Richard S. Sigman Washington Jul. 1972 75 p refs
(NASA-TM-X-2705; L-8675) Avail: NTIS HC $3.00 CSCL 09B

A multielement data reduction and analysis software package has been developed for use with the Langley differential maneuvering simulator (DMS). This package, which has several independent elements, was developed to support all phases of DMS aircraft simulation studies with a variety of both graphical and tabular information. The overall software package is considered unique because of the number, diversity, and sophistication of the element programs available for use in a single study. The purpose of this paper is to discuss the overall DMS data reduction and analysis package by reviewing the development of the various elements of the software, showing typical results that can be obtained, and discussing how each element can be used.
Author

N73-26179# Analysis and Computer Systems, Inc., Burlington, Mass.
DATA PROCESSING SYSTEM FOR THE SPHERICAL ELECTROSTATIC ANALYZER (SEA) EXPERIMENT FLOWN ON THE ISIS-A SATELLITE Final Report, 1 Nov. 1969 - 31 Oct. 1972
Allan G. Cronin, James R. Delaney, James R. McMurray, and George C. Sarris Nov. 1972 103 p
(Contract F19628-70-C-0059)
(AD-760148; AFCRL-TR-73-0076) Avail: NTIS CSCL 09/2

The report discusses the data system developed to process experimental telemetry data from the Spherical Electrostatic Analyzer (SEA) Experiment flown on the ISIS-A satellite. Data formats, reduction techniques and mathematical formulas are detailed. Anomolies from the experiment ideal and solutions to data processing problems encountered are discussed as possible aids in future development of similar large scale data base systems. Author (GRA)

N73-26180*# Case Western Reserve Univ., Cleveland, Ohio.
[SOFTWARE DESIGN STUDIES EMPHASIZING PROJECT LOGOS] Final Research Report, 1 Jun. 1969 - 31 May 1972
15 Mar. 1972 18 p refs Sponsored in part by ARPA
(Grant NGL-36-027-001)
(NASA-CR-130209) Avail: NTIS HC $3.00 CSCL 09B

The results of a research project on the development of computer software are presented. Research funds of $200,000 were expended over a three year period for software design and projects in connection with Project LOGOS (computer-aided design and certification of computing systems). Abstracts of theses prepared during the project are provided. Author

N73-26181# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
MODULAR GRAPHIC SOFTWARE FOR CAD
John-Neville Hambury 23 Jun. 1972 31 p refs
(MBB-UA-79-72-O) Avail: NTIS HC $3.75

The design of a graphics package for displaying the results of CAD calculations is described. The package contains a data structure capable of accepting a large amount of hierarchically structured information, on which many different operations may be performed. The package may be used as a graphic language or as a closed system. The graphic software consists of a number of modules which may be modified individually without affecting the whole structure. Three different graphic languages are used to perform all the graphic operations and for interaction.
Author (ESRO)

N73-26182# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INTERFACE MESSAGE PROCESSOR: SPECIFICATIONS FOR THE INTERCONNECTION OF A HOST AND INTERFACE MESSAGE PROCESSOR (IMP)
Apr. 1973 150 p refs Revised
(Contract DAHC15-69-C-0179; ARPA Order 1260)
(AD-759433; BBN-1822-Rev) Avail: NTIS CSCL 09/2

The document contains specifications for interconnecting a Host and an IMP. Discussion includes the general requirements, system operation, hardware requirements and description, and IMP background programs. GRA

N73-26183# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
IMAGE PROCESSING RESEARCH Semiannual Technical Report, 1 Sep. 1972 - 28 Feb. 1973
William K. Pratt 28 Feb. 1973 153 p refs
(Contract F08606-72-C-0008; ARPA Order 1706)
(AD-759038; USCEE-444) Avail: NTIS CSCL 09/2

The research program has as its primary purpose the analysis and development of techniques and systems for efficiently generating, processing, transmitting, and displaying visual images and two dimensional data arrays. Research is oriented toward digital processing and transmission systems. Five task areas are reported on: Image Coding Projects - the investigation of digital bandwidth reduction coding methods; Image Enhancement and Restoration Projects - the improvement of image fidelity and presentation format; Image Data Extraction Projects - the recognition of objects within pictures and quantitative measurement of image features; Image Analysis Projects - the development of quantitative measures of image quality and analytic represents-

tion; Image Processing Support Projects development of image processing hardware and software support systems. (Author Modified Abstract) GRA

N73-26184# Illinois Univ., Urbana. Coordinated Science Lab.
HIGH DENSITY OPTICAL MEMORY Quarterly Progress Report, Jan. - Mar. 1973
H. W. Knoebel and H. V. Krone Apr. 1973 9 p refs
(Contract N00014-67-A-0305-0015)
(AD-759032) Avail: NTIS CSCL 09/2

Work during this quarter includes measurements of memory crystal properties, electron coloration of KCl:NaCl, new system development, and improvement of existing system components. GRA

N73-26185# Texas Univ., Austin. Electronics Research Center.
A STUDY IN SOFTWARE RELIABILITY AND EVALUATION
Robert Edward Meeker, Jr. and C. V. Ramamoorthy 15 Feb. 1973 89 p refs
(Contract F44620-71-C-0091; Grant NSF GJ-2845; AF Proj. 4751)
(AD-760144; TM-39; AFOSR-73-0763TR) Avail: NTIS CSCL 09/2

The subject of software reliability is introduced and current methods are examined. Theoretical techniques which attempt to prove program correctness are described and their limitations noted. The problems encountered in evaluating and validating large programs are investigated, and an initial step toward automatic validation is presented in the form of an Automated Software Evaluation System. Author (GRA)

N73-26186# Massachusetts Inst. of Tech., Cambridge.
STORAGE HIERARCHY SYSTEMS Ph.D. Thesis, 1972
Stuart Elliot Madnick Apr. 1973 157 p refs
(Contract N00014-70-A-0362-0006; ARPA Order 2095; Proj. MAC)
(AD-760001; MAC-TR-107) Avail: NTIS CSCL 09/2

The relationship between the page size, program behavior, and page fetch frequency in storage hierarchy systems is formalized and analyzed. It is proven that there exist cyclic program reference patterns that can cause page fetch frequency to increase significantly if the page size used is decreased (e.g., reduced by half). Furthermore, it is proven in Theorem 3 that the limit to this increase is a linear function of primary store size. Thus, for example, on a typical current-day paging system with a large primary store, the number of page fetches encountered during the execution of a program could increase 200-fold if the page size were reduced by half. The concept of temporal locality versus spatial locality is postulated to explain the relationship between page size and program behavior in actual systems. A design for a general multiple level storage hierarchy system is presented. (Author Modified Abstract) GRA

N73-26187# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
EYES AND EARS FOR COMPUTERS
D. Raj Reddy Mar. 1973 34 p refs
(Contract F44620-70-C-0107; Grant NSF GJ-32784; AF Proj. 9769)
(AD-760153; AFOSR-73-0742TR) Avail: NTIS CSCL 09/2

The paper presents a unified view of the research in machine perception of speech and vision in the hope that a clear appreciation of similarities and differences may lead to better information-processing models of perception. Various factors that affect the feasibility and performance of perception systems are discussed. To illustrate the current state of the art in machine perception, examples are chosen from the HEARSAY speech understanding system and the image processing portion of the SYNAPS neural modelling system. Some unsolved problems in a few key areas are presented. Author (GRA)

N73-26188# Texas Univ., Austin. Electronics Research Center.
SCHEDULING PARALLEL PROCESSABLE TASKS FOR A UNIPROCESSOR
Thomas Francis Fox and C. V. Ramamoorthy 10 Jan. 1973 160 p refs
(Contract F44620-71-C-0091; Grant NSF GJ-28452; AF Proj. 4751)
(AD-760143; AFOSR-73-0764TR; TM-38) Avail: NTIS CSCL 09/2

Parallel Processable source program segments are scheduled so that multiprogramming can occur between them. Optimal and near-optimal methods of scheduling are examined. The heuristic methods are shown to be preferable to the optimal methods. The effect of inaccurate estimates of the time requirements of the program segments are considered. Memory constraints on the possible schedules are also evaluated. Implementation of the scheduling schemes is discussed. Author (GRA)

N73-26189# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
NATURAL COMMUNICATION WITH COMPUTERS IV Quarterly Progress Report, 1 Jan. - 31 Mar. 1973
Apr. 1973 84 p
(Contract DAHC15-71-C-0088)
(AD-760024; BBN-2544; QPR-10) Avail: NTIS CSCL 09/2

Natural Communications with Computers IV, broad based computer science research and development work is performed in areas including; speech understanding systems, development of programs and programming aids, techniques for extending computer I/O capabilities, research and development on time sharing systems, and distributed computation. This research program involves the ability to represent knowledge and deal with it in computer oriented terms, requires systems capable of a high degree of man-machine interaction, and draws upon may diverse fields such as linguistics, communications, programming, hardware development, speech recognition, etc. modes of communication with computers. Author (GRA)

N73-26190# Brown Univ., Providence, R.I.
SOFTWARE SUPPORT PACKAGES FOR THE VECTOR GENERAL ON DSC'S META 4 AND DEC'S PDP-11
Martin J. Michel Dec. 1972 31 p refs
(Contract N00014-67-A-0191-0023; Grant NSF GJ-28401)
(AD-760304) Avail: NTIS CSCL 09/2

Software support for applications programs using an intelligent graphics satellite configuration, falls into four categories of increasing complexity: stand-alone interactive plotting, satellite interactive plotting, stand-alone interactive design, and satellite interactive design. Two software/hardware systems are described. The first makes use of standard, off-the-shelf equipment to provide a cost-effective answer for most graphic applications. The second provides a laboratory for expanding the state-of-the-art in the area of advanced intelligent satellite processing. Author (GRA)

N73-26191# Auburn Univ., Ala. Digital Systems Lab.
A COMPUTER AIDED PROCEDURE FOR COMPLETE DESIGN OF SEQUENTIAL MACHINES
S. G. Shiva and H. T. Nagle, Jr. Mar. 1973 100 p refs
(Contract DAAH01-68-C-0296)
(AD-759959; AU-T-26) Avail: NTIS CSCL 09/2

A complete design procedure for both completely and incompletely specified sequential machines is discussed. Starting with the state table for the machine, the state minimization and state assignments are performed. The minimized Boolean functions for next state and output circuits for a D-flip flop implementation of the circuit are generated. The algorithm is discussed with examples and the complete FORTRAN source program listing is included. Author (GRA)

N73-26192# Control Data Corp., Ottawa (Ontario).
TACTICAL ROUTING INDICATOR LOOK-UP AND HEADER PREPARATION DEVICE (TACRAHD) Semiannual Progress Report, 1 Jul. - 29 Dec. 1972
Steven R. Sherman and Nigel R Denyer Fort Monmouth, N. J. ECOM Jan. 1973 61 p
(Contract DAAB07-72-C-0189)
(AD-759944; CDC-R583/110/R1; ECOM-0189-1-72) Avail: NTIS CSCL 09/2

The report describes work done and progress made during the first six months of the design and fabrication of the Advanced Development Model (Feasibility Type), on the Tactical Routing

Indicator Look-up and Header Preparation Device (TACRAHD). The major portion of the progress made during the period covered by the report was in the familiarization and development of circuitry using the latest state-of-the-art, large scale integrated circuits. The re-evaluation of basic designs made it possible to minimize the design effort while optimizing circuit usage. Furthermore, progress has been made in the mechanical design so as to permit access, maintenance, and replacement of all major assemblies and subassemblies with a minimum of effort. (Author Modified Abstract) GRA

N73-26193# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
INTERFACE MESSAGE PROCESSORS FOR THE ARPA COMPUTER NETWORK Quarterly Technical Report, 1 Jan. - 31 Mar. 1973
Frank E. Heart Apr. 1973 28 p
(Contract F08606-73-C-0027; ARPA Order 2351)
(AD-760023; BBN-2541; QTR-1) Avail: NTIS CSCL 09/2

A major activity during the first quarter has been making Interface Message Processors (IMP)s less sensitive to hardware failures in themselves or their neighbors. The motivation for, and conclusions of, this effort are described. Work on the High Speed Modular IMP (HSMIMP) continued through the first quarter. A survey and progress report on the HSMIMP development is described. The problems of subnetwork routing are studied. Satellite communications effort centered around three areas: study of the long-term placement of Satellite IMPs; continued simulation and analysis of the Reservation-ALOHA and other related satellite protocols; and study, analysis, and simulation of algorithms for slotting a broadcast channel. GRA

N73-26194# Mitre Corp., Bedford, Mass.
SDBP: A SMALL DATA BASE PACKAGE
W. Amory Dec. 1972 30 p refs
(Contract F19628-71-C-002; AF Proj. 515A)
(AD-760103; MTR-2403-Vol-1; ESD-TR-72-284-Vol-1) Avail: NTIS CSCL 09/2

A collection of computer programs, documentation, procedures and data base design criteria have been packaged for handling small to medium-sized data bases. This first volume of the series gives a system overview of the resulting data base tools and techniques, which were developed largely in support of the MACIMS analysis effort. Subsequent volumes provide user information for each part of the system. Author (GRA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-26195* Airborne Instruments Lab., Deer Park, N.Y.
HIGH-Q BANDPASS RESONATORS UTILIZING BANDSTOP RESONATOR PAIRS Patent
Herman C. Okean, inventor (to NASA) Issued 5 Jun. 1973 8 p Filed 27 Nov. 1970 Supersedes N71-28470 (09 - 16, p 2570) Sponsored by NASA
(NASA-Case-GSC-10990-1; US-Patent-3,737,815; US-Patent-Appl-SN-93329; US-Patent-Class-333-73R; US-Patent-Class-333-73S; US-Patent-Class-333-82A; US-Patent-Class-333-84M) Avail: US Patent Office CSCL 09E

A high-Q bandpass resonators utilizing composite bandstop resonator pairs is reported. The bandstop resonator pairs are formed of composite series or parallel connected realizable transmission line elements. The elements are exclusively either quarter-wavelength lines or half-wavelength lines.
Official Gazette of the U.S. Patent Office

N73-26196*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STABLE SUPPLY OSCILLATOR Patent Application
John F. Hamlet, inventor (to NASA) Filed 15 Jun. 1973 13 p
(NASA-Case-MFS-21698-1; US-Patent-Appl-SN-370505) Avail: NTIS HC $3.00 CSCL 09A

The design of a circuit for the generation of oscillations with amplitude and frequency stability of the signals is discussed. The circuit is used with measurement transducers as a power supply. Diagrams of the circuit are provided. Application of the circuit for measuring liquid level in liquid propellant rocket engines is proposed. NASA

N73-26197*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTROSTATIC MEASUREMENT SYSTEM Patent Application
James E. Johnston, inventor (to NASA) Filed 15 Jun. 1973 9 p
(NASA-Case-MFS-22129-1; US-Patent-Appl-SN-370255) Avail: NTIS HC $3.00 CSCL 09A

A system for and method of contact electrifying a dielectric to determine its electrostatic properties are discussed. In operation, the dielectric to be tested is placed on the conducting plate which is then charged to about 5,000 volts dc This contact electrifies the dielectric. After the electrification is completed, the power source is turned off and the rate of decay of the charge on the dielectric is determined from a field meter.
NASA

N73-26198*# Radio Corp. of America, Princeton, N.J.
ROTARY SOLENOID SHUTTER DRIVE ASSEMBLY AND ROTARY INERTIA DAMPER AND STOP PLATE ASSEMBLY Patent Application
Walter L. Cable and Harold B. Dougherty, inventors (to NASA) Filed 21 May 1973 21 p Sponsored by NASA
(NASA-Case-GSC-11560-1; US-Patent-Appl-SN-361906) Avail: NTIS HC $3.25 CSCL 09E

The development of a rotary solenoid shutter drive assembly and a rotary inertia damper for use with cameras mounted in satellites is discussed. The components of the system are illustrated and the method of operation is described. Unique features of the system are that the shutter blades travel linearly and are controlled by the solenoid as is the damper assembly.
NASA

N73-26199*# Lockheed Electronics Co., Houston, Tex.
RANDOM PULSE GENERATOR Patent Application
Reed S. Lindsey, Jr., inventor (to NASA) Filed 25 Jun. 1973 22 p
(Contract NAS9-11373)
(NASA-Case-MSC-14131-1; US-Patent-Appl-SN-373588) Avail: NTIS HC $3.25 CSCL 09E

A random pulse generator is reported for supplying constant amplitude, randomly distributed pulses with an average repetition rate covering a wide dynamic range by use of a white noise source. By this random pulse generator the average random pulse rate can be varied in four ranges from a few counts per second to more than one million counts per second. NASA

N73-26200*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GUIDELINES FOR SELECTION AND APPLICATION OF TANTALUM ELECTROLYTIC CAPACITORS AT MSFC
A. M. Holladay, Leon C. Hamiter, Jr., and Benton A. Vizzier, Sr. (ITT, Federal Electric Corp.) 1 Feb. 1973 36 p
(NASA-TM-X-64755) Avail: NTIS HC $4.00 CSCL 09A

Guidelines for selection and application of three types of tantalum electrolytic capacitors in the design of electrical and electronic circuits for manned space flight missions are presented. In addition, the guidelines supplement requirements of existing Military Specifications used in procurement of capacitors. A need exists for these guidelines, to assist designers in preventing some of the recurring, serious problems experienced with tantalum electrolytic capacitors in the recent past. The three types of capacitors covered by these guidelines are; (1) solid (CSR), (2) wet foil (CLR 25, 27, 35, and 37), and (3) wet slug (CLR 65).
Author

N73-26201# Joint Publications Research Service, Arlington, Va.

USING HOLOGRAPHIC MATCHED FILTERS IN CORRECTING PHASE DISCONTINUTIES IN ANTENNA APERTURES

L. D. Bakhrakh and V. A. Makeyev 11 Jun. 1973 14 p refs Transl. into ENGLISH from Radiotekh. i Elektron. (Moscow), no. 4, 1973 p 741-748

(JPRS-59253) Avail: NTIS HC $3.00

A discussion is presented on the optical method for correcting phase heterogeneities of aperture antennas by using holographic match filters. Author

N73-26202*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

A BIBLIOGRAPHY OF THE THEORY AND APPLICATION OF THE PHASE-LOCK PRINCIPLE

William C. Lindsey (Univ. of Southern Calif.) and Robert C. Tausworthe 1 Apr. 1973 94 p refs

(Contracts NAS7-100; N00014-67-A-0269-0022)

(NASA-CR-133225; JPL-TR-32-1581) Avail: NTIS HC $6.75 CSCL 09C

A literature search was conducted in an effort to collect and compile as many references on the phase-locked loop as possible. Although not all inclusive, a comprehensive listing of approximately 800 references covering the past two decades of work reported throughout the world are presented. The compilation is given in two parts: first by categories, and then alphabetically by authors. Author

N73-26203*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

EVALUATION OF ERRORS IN PRIOR MEAN AND VARIANCE IN THE ESTIMATION OF INTEGRATED CIRCUIT FAILURE RATES USING BAYESIAN METHODS

B. C. Fletcher 1 Jun. 1972 65 p refs

(Contract NAS7-100)

(NASA-CR-133227; JPL-TM-33-614) Avail: NTIS HC $5.25 CSCL 09C

The critical point of any Bayesian analysis concerns the choice and quantification of the prior information. The effects of prior data on a Bayesian analysis are studied. Comparisons of the maximum likelihood estimator, the Bayesian estimator, and the known failure rate are presented. The results of the many simulated trails are then analyzed to show the region of criticality for prior information being supplied to the Bayesian estimator. In particular, effects of prior mean and variance are determined as a function of the amount of test data available. Author

N73-26204# Sandia Labs., Albuquerque, N.Mex.

COMPUTER CODES FOR POWER AMPLIFIER DESIGN

J. G. Webb Feb. 1973 28 p refs Sponsored by AEC

(SLA-73-153) Avail: NTIS

A computer code is described which finds the source and load impedances required to design a power amplifier for a desired gain and output power, based on measurements of the large-signal S-parameters of the active device. Stability criteria are also calculated for assuring that the resulting amplifier will not oscillate. Two additional computer programs are described which calculate the values of circuit elements for matching networks which will transform 50 ohms to the required source and load impedances calculated by the first program. Author

N73-26205# Stanford Univ., Calif. Electronics Labs.

COMPUTER-GENERATED LOCI ON SMITH CHARTS TO AID AMPLIFIER DESIGN

Nelson N. Chan Mar. 1973 60 p refs

(Contract N00014-67-A-0112-0038; SU Proj. 4025)

(AD-759701; SU-SEL-73-008; TR-4825-7) Avail: NTIS CSCL 09/5

The design of amplifier systems is greatly facilitated by the use of computers. An amplifying element is often represented by a linear two-port model, which is characterized by a set of s-parameters at a particular frequency or at a set of discrete frequencies. With the s-parameters, it is possible to plot loci of constant power gain and loci of constant imput impedance on a load-reflection-coefficient plane (Smith Chart). With these plots, the designer can conveniently select the appropriate load to obtain the desired power gain and input impedance of the amplifier system at the frequency of interest. The HP9810 calculator and its associated plotter have been programmed to generate the above mentioned loci directly on a Smith Chart. The input data consists of only the s-parameters of the two port. These plots are simple and informative and can be obtained in a matter of minutes. Author (GRA)

N73-26206# Mitre Corp., Bedford, Mass.

SYMBOL DESIGNS FOR THE GRAPHIC SYMBOL SUBSET OF THE ASCII

D. A. Shurtleff and P. Alexander Mar. 1973 26 p

(Contract F19628-73-C-0001; AF Proj. 4110)

(AD-759807; MTR-2456; ESD-TR-73-116) Avail: NTIS CSCL 09/5

Symbols in the Graphic Symbol subset of the ASCII were designed for use on AWACS(Airbone Warning And Control Systems) displays. These graphic symbol designs also are recommended for use in other systems where accurate and rapid symbol identification by operators is desirable. Author (GRA)

N73-26207# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

TACTICAL MINIATURE CRYSTAL OSCILLATOR Final Report, 1 Jul. 1971 - 30 Aug. 1972

Raymond K. Hart, Walter H. Hicklin, and Larry A. Phillips Apr. 1973 77 p refs

(Contract DAAB07-71-C-0301; DA Proj. 1H6-62705-A-058)

(AD-759484; GIT-A-1344-F; ECOM-0301-F) Avail: NTIS CSCL 09/5

The purpose of this work was to develop an experimental tactical miniature crystal oscillator (TMXO) in a 5 cubic inch volume, use -10 W warmup power from -40C to -85C in 1 min, and then operate on 250 mW. It was to reach a maximum deviation from final frequency of plus or minus 1 X 10 to the 7th power after a 1 min period. The short term stability requirement was to have a maximum rms frequency deviation of plus or minus 1 X 10 to the -11th power for averaging times from 1 sec to 20 min. GRA

N73-26208# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.

CHARACTERISTICS OF SUBHARMONICALLY INJECTION LOCKED MICROWAVE DIODE OSCILLATORS Interim Report

Chih-Hsien Chien Mar. 1973 151 p refs

(Contract F30602-71-C-0110)

(AD-759540; RADC-TR-73-48) Avail: NTIS CSCL 09/5

The report deals with a theoretical and experimental study of subharmonically injection locked microwave IMPATT diode oscillators which was conducted with the intent of improving the frequency stability, noise characteristics and modulation characteristics of the oscillators. Included in the report are sections on subharmonic locking theory, measurement techniques, and on the experimental results obtained. The final section of the report presents a summary of the results obtained and the conclusions derived from the study. In this section a broad introduction into IMPATT diodes is presented along with a review of the pertinent literature. GRA

N73-26209# Naval Research Lab., Washington, D.C.

THE ANALYSIS OF FINITE PLANAR ANTENNA ARRAYS Final Report

Alan G. Cha Mar. 1973 28 p refs

(SF11141009)

(AD-759008; NRL-MR-2568) Avail: NTIS CSCL 09/5

The numerical solution of antenna arrays has presented some challenging problems to antenna engineers in recent years. In the present work, the finite planar array problem is formulated as a matrix equation. It is shown that entries of the matrix are independent of the scan angles and it is necessary to compute and invert the matrix only once in order to obtain information on the array scanning operation at any angular position. It is also shown that the use of certain symmetry relations greatly reduces the computation time of the matrix entries. Finally, a numerical example is given to demonstrate the effectiveness of the matrix formulation in treating finite array problems. GRA

N73-26210# Pennsylvania State Univ., University Park. Ordnance Research Lab.

ADAPTIVE HIGH Q NOTCH FILTER M.S. Thesis
Lynn A. Poole 15 Aug. 1972 96 p refs
(Contract N00017-70-C-1407)
(AD-759031; TM-72-231) Avail: NTIS CSCL 09/5

The report develops the information, techniques, and circuitry for the realization of an adaptive notch filter. The principal application, considered in the filter design, was for the operation of the adaptive notch in conjunction with a real time signal processor. The design equation expresses the circuit components for the independent control of the filter response in terms of the desired filter characteristics of notch width, notch depth, and center frequency. The experimental evaluation includes the adaptive characteristics, the transient behavior associated with the adaptation of the filter as well as the usual characteristics of system bandwidth, self noise, dynamic range and performance variation with temperature. The achieved performance establishes high expectations for the incorporation of an adaptive notch in a real time signal processor. Author (GRA)

N73-26211# Virginia Univ., Charlottesville.
SUPERFLUID COOLING OF HEATED WIRES IN LIQUID HELIUM Final Report, Feb. 1970 - Oct. 1972
Frank L. Hereford and Glenn E. Spangler Dec. 1972 31 p refs
(Contract DAAK02-70-C-0255; DA Proj. 1T0-61102-A-34A)
(AD-759958) Avail: NTIS CSCL 09/1

Investigations are concerned with the phenomena associated with the heating of small diameter wires immersed in superfluid liquid helium. Experimental results are presented relating to the critical heat currents associated with the appearance and disappearance of stable vapor films surrounding heated wires. These experiments were carried out at helium bath temperatures between 1.4K and 2.18K Variation of the critical wattages with fluid pressure and temperature were observed. The results of measurements performed at temperatures below 1K are described. (Author Modified Abstract) GRA

N73-26212# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BEAM SEMICONDUCTOR S-BAND AMPLIFIER Triannual Report, 1 Jul. - 31 Oct. 1972
Lester A. Roberts May 1973 56 p refs
(Contract DAAB07-72-C-0220; W-J Proj. 22-4102)
(AD-759948; W-J-22-4102R1; ECOM-0220-1-73; TAR-1) Avail: NTIS CSCL 09/5

The design analysis for the semiconductor target was carried out. Large signal calculations were carried out which included transit time and deep junction effects. The first pinhole target tube was built and measurements were made on a sheet electron beam produced by the four anode gun. Redesign of the pinhole masks of the target mount was undertaken to give CW operating capability. Design, construction and testing of heat exchangers for the high power density target mount was undertaken. Based upon test results, and improved heat exchanger design was conceived and built, but not tested by the end of the period. Study of diode bonding techniques took place with a goal of obtaining completely void free bonds between the semiconductor diodes and the target substrate. Author (GRA)

N73-26213# Office of Naval Research, London (England).
COLLOQUIUM ON MICROWAVE TRANSISTORS
Arthur Waynick 31 Mar. 1973 16 p Colloq. held at London, 13 Dec. 1972
(AD-760315; ONRL-C-8-73) Avail: NTIS CSCL 09/1

A report is made on a one-day symposium concerned with the design, modelling and fabrication of microwave transistor devices. The program was designed for the specialist in this field and, in general, the eleven papers reported were essentially current status reports of the areas covered. Author (GRA)

N73-26214# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
INVESTIGATIONS OF METAL-BURIED SILICIDE-SILICON STRUCTURES AND METAL-TITANIUM OXIDE-SILICON STRUCTURES
R. J. Kopp and W. W. Grannemann May 1973 178 p refs
(Contract N00014-68-A-0158)
(AD-760009; EE-203(73)ONR-005) Avail: NTIS CSCL 09/1

Various MIS (metal-insulator-semiconductor) capacitors were fabricated on single-crystal silicon substrates. Widely differing insulator-material films and processing techniques were used in the construction of these capacitors. These MIS structures were used as test vehicles in several investigations of selected practical and theoretical problems of present engineering interest. Electrical and physical characterizations of these systems are presented along with some modeling of insulator-film bulk properties and properties of the insulator-semiconductor interface regions. Also presented are the chemical, physical, and photolithographic processing methods used in the construction of these MIS structures. (Author Modified Abstract) GRA

N73-26215# IIT Research Inst., Chicago, Ill. Reliability Analysis Center.
MICROCIRCUIT DEVICE MALFUNCTION REPORT
Irvin L. Krulac Feb. 1973 126 p
(Contract F30602-73-C-0065)
(AD-759846; RAC-MDMR-0273) Avail: NTIS CSCL 09/1

The report provides a complete history of malfunctions reported during equipment assembly, test checkout and field operations. Where performed, failure autopsy results and corrective actions are also indicated. The listing is organized and presented by manufacturer and part type. Entries also identify other pertinent device descriptors such as applied screens, package type, manufacturing date code as well as the system designation on the date malfunction was reported. (Author Modified Abstract) GRA

N73-26216# Aerospace Corp., El Segundo, Calif. Electronics Research Labs.
THE 225- TO 400-MHz CAVITY-BACKED DIPOLE WITH ALMOST CONSTANT GAIN
Jimmy L. Wong and Howard E. King 15 May 1973 17 p refs
(Contract F04701-72-C-0073)
(AD-760126; TR-0073(3401)-1; SAMSO-TR-73-160) Avail: NTIS CSCL 09/5

A circularly polarized radiating element with a gain of 10.5 plus or minus 1 db over the 225- to 400-MHz band is described. The antenna consists of an open-sleeve dipole backed by a cavity 56 in. in diameter and 14.8 in. high. VSWR, axial ratio, pattern, and gain characteristics are presented. The measurements were made on a half-scale model, and all results are referred to the 450- to 800-MHz frequency band. Author (GRA)

N73-26217# Admiralty Surface Weapons Establishment, Portsmouth (England).
THE DESIGN OF AN OMNI-DIRECTIONAL UHF WRAP ROUND ANTENNA
J. E. G. Wyatt Apr. 1972 24 p ref
(AD-760201; ASWE-TR-72-33; BR34868) Avail: NTIS CSCL 09/5

The report describes the development of an omni-directional UHF communication antenna, intended to be fitted around an encastre polemast. Stress is laid upon the requirement of RF linearity as each antenna may be required to support up to fourteen simultaneous channels within the band. Author (GRA)

N73-26218# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
POWER SUPPLY, ELECTRICAL Final Report
Oct. 1972 24 p refs
(AD-759926; TOP-6-2-210) Avail: NTIS CSCL 09/5

The report describes a method for evaluation of electrical power supply operational and performance characteristics; identifies supporting tests, facilities, and equipment required; provides procedures for safety, input and output regulation, ripple, output transient voltage, overload protection, power changeover, meter accuracy, efficiency, visual-mechanical inspection, environmental tests, human factors, and electromagnetic interference. The report is applicable to conversion type electrical supplies, rotary and static converters, but not applicable to power supply converters that convert energy in any form other than electrical to electrical energy. Author (GRA)

N73-26219# Physical Electronics Labs., Menlo Park, Calif.
BROADBAND FERRITE LIMITERS Interim Report, 1 Jul. 1972 - 31 Jan. 1973

Scott S. Elliott and Ove Wetterhorn Apr. 1973 44 p refs
(Contract DAAB07-72-C-0305)
(AD-759951; ECOM-0305-1-73; IR-1) Avail: NTIS CSCL 09/1

The object of the program was to develop and demonstrate a broadband frequency selective ferrite limiter in the frequency range from 8 to 10 and 10 to 12 GHz. The design goals are to achieve a relatively low threshold power (100 mW) with a low level insertion loss of 1.0 db. The device will operate in the subsidiary resonance mode using a periodic array of dielectric resonators. A prototype device was built and tested, and the results are discussed. Author (GRA)

N73-26220# Collins Radio Co., Cedar Rapids, Iowa.
HIGH-STABILITY TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR STUDY (HSTCXO) Final Report, 1 Mar. 1971 - 15 Dec. 1972
Gayle E. Buroker Apr. 1973 85 p refs
(Contract DAAB07-71-C-0136; DA Proj. 1H6-62705-A-058)
(AD-759938; ECOM-0136-F-71) Avail: NTIS CSCL 09/5

A high-stability temperature-compensated crystal oscillator (HSTCXO) has been developed for eventual use in advanced SSB communications equipment. Important features of the oscillator are small frequency variations with temperature (plus or minus 5 pp x 10 to the 8th power from -40 to -80 C), low power (150 mW), fast warmup (1 pp x 10 to the 8th power in 1 minute), and insensitivity to load and voltage variations (plus or minus 5 pp x 10 to the 9th power). A principal objective of the study, in addition to achieving the desired performance levels, was to develop compensation procedures that are practical and economical for high-volume production. A well-delineated compensation method has been developed and tested in the course of fabricating 10 exploratory models. Compensation is achieved in two steps: coarse, by established voltage divider techniques, and fine, by a new digital technique previously conceived at Collins Radio Company. (Author Modified Abstract) GRA

N73-26221# Stanford Univ., Calif. High Energy Physics Lab.
A SUPERCONDUCTING CAVITY STABILIZED OSCILLATOR OF HIGH STABILITY
S. R. Stein and J. P. Turneaure Apr. 1972 15 p refs Submitted for publication
(Contract N00014-67-A-0112-0061)
(AD-760339; SU-HEPL-673) Avail: NTIS CSCL 09/5

Superconducting Nb cavities of high Q were used to stabilize Gunn-effect oscillators. These stabilized oscillators given a rms fractional frequency fluctuation, sigma sub y(N = 2, r = 1.1004, tau = 10s), of 1.2 + or - 0.1 x 10 to the minus 13th power for an averaging time of 10 sec. Author (GRA)

N73-26222# California Inst. of Tech., Pasadena. Antenna Lab.
DIFFERENTIAL-GEOMETRY SCALING METHOD FOR ELECTROMAGNETIC FIELD AND ITS APPLICATIONS TO COAXIAL WAVEGUIDE JUNCTIONS
Tse Chin Mo, Charles H. Papas, and Carl E. Baum Mar. 1973 102 p refs
(Grant AF-AFOSR-1935-70; AF Proj. 9768)
(AD-760157; TR-66; AFOSR-73-0762TR) Avail: NTIS CSCL 09/1

A differential geometry scaling method, stemming from Baum's pioneering work, is thoroughly explored and developed for electromagnetic fields. This method creates a class of equivalent electromagnetic problems P each described by a complicated geometry and having a complicated medium from an electromagnetic problem P: described by a simple Cartesian geometry and having a simple medium. Application of this method to coaxial waveguide structures is examined with special emphasis. Various conditions and limitation of the method as imposed by special choices of geometry, medium and field modes are obtained. Also two specific problems are solved in detail by applying this scaling method. GRA

N73-26223# Westinghouse Research Labs., Pittsburgh, Pa.
THE 15 GIGAHERTZ ACOUSTIC Interim Report, 1 Aug. 1972 - 28 Feb. 1973
J. DeKlerk 28 Feb. 1973 25 p refs
(Contract N00014-69-C-0118)
(AD-760020) Avail: NTIS CSCL 09/1

The aim of the program is to conduct research on the use of bulk elastic waves for signal processing up to 15 GHz. Principles of detection of a bulk elastic wave anywhere along its path will be investigated. This will be implemented experimentally, at first in the 1-2 GHz range, to show feasibility of the concept of bulk wave detection using surface sensors, by designing and fabricating a pulse compression filter for operation in this frequency range. GRA

N73-26224# Westinghouse Electric Corp., Baltimore, Md. Systems Development Div.
BINARY ADDRESSABLE SCAN CONVERSION STORAGE TUBE Quarterly Progress Report, 15 Jul. - 14 Oct. 1972
D. Mergerian, John W. Ogland, Hader J. Bourg, Igor Limansky, and J. C. Bradley Dec. 1972 66 p refs
(Contract DAAB07-72-C-0052)
(AD-759966; ECOM-0052-4-73; QR-4) Avail: NTIS CSCL 09/1

Three hole arrays were drilled this quarter. The major portion of the effort this quarter was directed toward correcting problems with the laser drill facility so that the tolerances on hole locations can be met. A major portion of the optics of the laser drill was redesigned and re-worked to correct beam wandering during drilling. Also several problems with cleaning of the wafers both before and after drilling have been corrected. Electrode mask depositions has been carried out. The address electronics has been designed. (Author Modified Abstract) GRA

N73-26225# Naval Underwater Systems Center, Newport, R.I.
CORRELATION LOSS OF A GAUSSIAN SIGNAL PASSED THROUGH AN ODD QUANTIZER
John W. Fay 30 Apr. 1973 27 p refs
(SF11121102)
(AD-760310; NUSC-TR-4485) Avail: NTIS CSCL 09/4

Analysis and simulation show that the correlation loss experienced by a Gaussian signal passed through an odd quantizer is independent of the signal-to-noise ratio at the input when the input rms value is fixed. The correlation coefficient of input signal component and quantizer output is shown to be a weighted version of the corresponding input correlation coefficient. Furthermore, intervals of input rms voltage exist over which a given linear quantizer should be operated to minimize correlation loss. Author (GRA)

N73-26226# EIMAC, San Carlos, Calif.
DESIGN STUDY OF A LARGE AREA CYLINDRICAL ELECTRON GUN Final Report, 1 Jun. - 31 Dec. 1972
William H. Sain 31 Dec. 1972 58 p refs
(Contract N00014-72-C-0495; ARPA Order 1806; NR Proj. 016-313)
(AD-760047; EIMAC-TR-73-4) Avail: NTIS CSCL 09/1

The study was concerned with the design of a large cylindrical electron gun (5 meters long by 1 to 2 meters in diameter) and the application of state-of-the-art high power electron tube technology to this design. A design which applies welded thoriated tungsten mesh cathodes and refractory metal grids (as used in power tubes) was investigated. Vibration characteristics of prototype mesh filaments were calculated and measurements of filament resonant frequencies confirmed the predictability of the behavior of mesh filaments. Experiments were performed on titanium foil windows which were diffusion bonded or brazed to cylindrical sealing members. These were vacuum tight after high temperature bakeout and confirmed the feasibility of fabricating modular, bonded electron window structures. Author (GRA)

N73-26227# TRW Semiconductors, Inc., Lawndale, Calif. Semiconductor Div.
SOLID STATE AMPLIFIER LINEARIZATION TECHNIQUES FOR INTERFERENCE REDUCTION IN USAF COMMUNICATIONS SYSTEMS Final Technical Report
Edward R. Moss and Roger DeBloois Griffiss AFB, N. Y. RADC Jan. 1973 97 p refs
(Contract F30602-71-C-0247)
(AD-757558; TRW-71-0247; RADC-TR-73-10) Avail: NTIS

CSCL 09/5

The report describes the development of the TRW J02009 linear power transistor and the design of a broadband UHF amplifier using these transistors. The amplifier uses two J02009 transistors with hybrid power splitting and summing techniques to combine the two transistors. The amplifier has a bandwidth of 225 to 400 MHz, a peak envelope output power of 50 watts, and gain that varies from 8 db to 14 db over the band. (Author Modified Abstract) GRA

N73-26657 Joint Publications Research Service, Arlington, Va.
COMPUTATION OF UNRELIEVED ELECTROMAGNETIC FORCES OF ATTRACTION OF THE ROTOR OF AN ELECTRIC MOTOR
Ya. Ya. Berzin *In its* Navigational Instr. 12 Jun. 1973 p 1-6 ref (For availability see N73-26656 17-21)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-26228* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARASITIC SUPPRESSING CIRCUIT Patent
John T. Fowler and Frank L. Raposa, inventors (to NASA) Issued 5 Jun. 1973 4 p Filed 15 May 1972 Supersedes N72-25280 (10 - 16, p 2136)
(NASA-Case-ERC-10403-1; US-Patent-3,737,757; US-Patent-Appl-SN-253405; US-Patent-Class-321-11; US-Patent-Class-317-DIG.6; US-Patent-Class-321-45C) Avail: US Patent Office CSCL 09C

A circuit for suppressing parasitic oscillations across an inductor operating in a resonant mode is described. The circuit includes a switch means and resistive means connected serially across the inductor. A unidirectional resistive-capacitive network is also connected across the inductor and to the switch means to automatically render the switch means conducting when inductive current through the inductor ceases to flow.
Official Gazette of the U.S. Patent Office

N73-26229* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LOW PHASE NOISE DIGITAL FREQUENCY DIVIDER Patent
George F. Lutes, Jr., inventor (to NASA) Issued 5 Jun. 1973 9 p Filed 18 Nov. 1971 Supersedes N72-20231 (10 - 11, p 1449) Sponsored by NASA
(NASA-Case-NPO-11569; US-Patent-3,737,676; US-Patent-Appl-SN-199957; US-Patent-Class-307-220; US-Patent-Class-307-233) Avail: US Patent Office CSCL 09C

A low phase noise frequency divider composed of a grating arrangement is disclosed. The grating arrangement supplies selected portions of an input reference signal to be divided to a tuned circuit without any phase noise due to the grating action. The arrangement which in one embodiment consists of an FET is connected to the tuned circuit input to short out the input except when the input reference signal amplitude crosses ground level in a positive direction and a gate enabling signal is present at the gate electrode of the FET. The gate enabling signal alone does not decouple the tuned circuit input from ground, therefore phase noise, due to the leading and trailing edges of each gate-enabling signal, is substantially eliminated.
Office Gazette of the U.S. Patent Office

N73-26230* Martin Marietta Corp., Denver, Colo.
DERIVATION OF A TANGENT FUNCTION USING AN INTEGRATED CIRCUIT FOUR-QUADRANT MULTIPLIER Patent
Bernard J. Bregman, inventor (to NASA) Issued 5 Jun. 1973 4 p Filed 17 May 1972 Supersedes N72-25281 (10 - 16, p 2136) Sponsored by NASA
(NASA-Case-MSC-13907-1; US-Patent-3,737,639; US-Patent-Appl-SN-254177; US-Patent-Class-235-186; US-Patent-Class-235-194; US-Patent-Class-235-197) Avail: US Patent Office CSCL 09C

A tangent function generator is provided which utilizes input signals proportionate to the sine and cosine of a given angle. The equipment accomplishes a trigonometric manipulation which forms an output signal substantially independent of the input reference voltage but proportional to the tangent of the angle. The device uses a multiplier and operational amplifier.
Official Gazette of the U.S. Patent Office

N73-26231*# Lockheed Electronics Co., Houston, Tex.
PEAK HOLDING CIRCUIT FOR EXTREMELY NARROW PULSES Patent Application
Robert W. ONeill, inventor (to NASA) Filed 21 May 1973 12 p
(Contract NAS9-11373)
(NASA-Case-MSC-14129-1; US-Patent-Appl-SN-362146) Avail: NTIS HC $3.00 CSCL 09C

An improved pulse stretching circuit is described comprised of a high speed wide-band amplifier connected in a fast charge integrator configuration, a holding circuit including a capacitor connected in parallel with a discharging network which employs a resistor and an FET, and an output buffer amplifier. Input pulses of very short duration are applied to the integrator charging the capacitor to a value proportional to the input pulse amplitude. After a predetermined period of time, conventional circuitry generates a dump pulse which is applied to the gate of the FET making a low resistance path to ground which discharges the capacitor. When the dump pulse terminates, the circuit is ready to accept another pulse to be stretched. The very short input pulses are thus stretched in width so they may be analyzed by conventional pulse height analyzers. NASA

N73-26232*# Lockheed Electronics Co., Houston, Tex.
PULSE STRETCHER FOR NARROW PULSES Patent Application
Reed S. Lindsey, Jr., inventor (to NASA) Filed 25 Jun. 1973 20 p
(Contract NAS9-11373)
(NASA-Case-MSC-14130-1; US-Patent-Appl-SN-373587) Avail: NTIS HC $3.00 CSCL 09C

A pulse stretcher for processing narrow pulses is described. The stretcher is composed of an analog section for processing arriving analog pulses and a digital section with logic for providing command signals to the gates and switches in the analog section. NASA

N73-26233# Royal Aircraft Establishment, Farnborough (England).
ELECTRONIC MODULES FOR ASTRONAUTICS. PART 1: MODULES FOR THE ACQUISITION OF EXPERIMENTAL DATA
H. V. Ellen, S. Padmanabhan, K. Rammelsberger, and F. Ruff Dec. 1972 52 p Transl. into ENGLISH from Ger. Federal Min. for Educ. and Sci., report no. BMBW-FB-W-71-42
(RAE-Lib-Trans-1643-Pt-1; BR32816) Avail: NTIS HC $4.75

Electronic modules intended for use in scientific space instrument are studied. The aim of the work was to develop high voltage power supplies for photomultiplier tubes or other radiation detectors as well as modules able to process signals supplied by semiconductors. Two types of low noise, charge sensitive preamplifiers and one main amplifier module have been developed and built as thick film microelectronic circuits. Investigations and tests of high voltage sources have been carried out to adapt the circuits and the technology to the experimenters' special requirements. Author

N73-26234*# California Univ., Berkeley. Electronics Research Lab.
THE L SUP p STABILITY (1 LESS THAN OR EQUAL TO p LESS THAN OR EQUAL TO INFINITY) OF MULTIVARIABLE NONLINEAR TIME VARYING FEEDBACK SYSTEMS THAT ARE OPEN LOOP UNSTABLE
Frank M. Callier and Charles A. Desoer [1972] 13 p refs
(Grant NGL-05-003-016)
(NASA-CR-133183) Avail: NTIS Hc $3.00 CSCL 09C

A class is considered of multivariable, nonlinear time-varying feedback systems with an unstable convolution subsystem as

feedforward and a time-varying nonlinear gain as feedback. The impulse response of the convolution subsystem is the sum of (1) a finite number of increasing expotentials multiplied by nonnegative powers of the time t, (2) a term that is absolutely integrable and (3) a infinite series of delayed impulses. The main result is a theorem. It essentially states that if the unstable convolution subsystem can be stabilized by a constant feedback gain F and if the incremental gain of the difference between the nonlinear gain function and F is sufficiently small, then the nonlinear system is L supp-stable for any p eta 1, infinity; furthermore the solutions of the nonlinear system depend continuously on the inputs in any L sup-norm. The fixed point theorem is crucial in deriving the above theorem. Author

N73-26235# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
TWENTY-FIVE YEARS OF SCIENTIFC RESEARCH SPONSORED BY THE JOINT SERVICES ELECTRONICS PROGRAM AT HARVARD UNIVERSITY Interim Technical Report
N. Bloembergen and J. A. Pierce Apr. 1973 39 p
(Contract N00014-67-A-0298-0006; NR Proj. 372-012; NR Proj. 372-012)
(AD-759990; TR-644) Avail: NTIS CSCL 09/3

Contents: Twenty-five years of scientific research sponsored by the Joint Services Electronics Program at Harvard University -- a case history; Research in radio wave propagation and aids to navigation; A brief review of research in electromagnetic radiation. GRA

N73-26236# Stanford Research Inst., Menlo Park, Calif.
MICROWAVE NETWORK SYNTHESIS Final Report, 1 Feb. 1972 - 31 Jan. 1973
Alfred J. Bahr, Robert E. Lee, Edward G. Cristal, and Ulrich H. Gysel Apr. 1973 151 p refs
(Contract DAAB07-72-C-0127; SRI Proj. 1679)
(AD-759934; ECOM-0127-F-73) Avail: NTIS CSCL 09/1

The results of a theoretical and experimental study of the surface-acoustic-wave grating transducer are presented. The results of a study of several transducer structures that were designed to result in enhanced excitation of surface acoustic waves at odd-harmonic frequencies are also presented. Equivalent-circuit models for a hybrid multisection grating structure having one floating electrode per section and for an interdigital structure having an arbitrary mark-to-space ratio are described. A compact channel-dropping-filter geometry consisting of hairpin bandpass and folded-line bandstop filters is described for stripline and microwave intergrated circuits. Design tables and theoretical and experimental data for a trial channel-dropping filter are presented. (Author Modified Abstract) GRA

N73-26237# Hughes Research Labs., Malibu, Calif.
BEAM TECHNIQUES FOR THE FABRICATION OF INTEGRATED OPTICS CIRCUITS Final Report, 11 Sep. 1972 - 31 Jan. 1973
E. D. Wolf, H. L. Garvin, and R. G. Wilson Mar. 1973 49 p refs
(Contract N00123-73-C-0231)
(AD-760051) Avail: NTIS CSCL 09/1

Electron beam lithography and ion beam sputtering have been used to fabricate micron-size waveguides in thermally grown SiO2, in chemical vapor deposited SiO2, and in ion beam sputter-deposited SiO2. In addition, waveguides were made directly in polymethyl methacrylate and the waveguide cross section was demonstrated as controllable using isochronal annealing above the glass-transition temperature (about 110C) of polymethyl methacrylate. Waveguides, with only a few hundred Angstrom edge roughness, were obtained. (Author Modified Abstract) GRA

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-26238* Comprehensive Designers, Inc., Sherman Oaks, Calif.
VEHICLE FOR USE IN PLANETARY EXPLORATION Patent
Edward Hryniewiecki, inventor (to NASA) Issued 1 May 1973 11 p Filed 17 May 1971 Supersedes N71-35382 (09 - 22, p 3564) Sponsored by NASA Prepared for JPL
(NASA-Case-NPO-11366; US-Patent-3,730,287;
US-Patent-Appl-SN-144139; US-Patent-Class-180-6.5;
US-Patent-Class-180-7R; US-Patent-Class-180-8A;
US-Patent-Class-180-9.2R; US-Patent-Class-180-9.5;
US-Patent-Class-180-41; US-Patent-Class-305-35EB;
US-Patent-Class-305-39) Avail: US Patent Office CSCL 13F

A self-propelled vehicle particularly suited for use in traversing hostile terrain is described. The vehicle is characterized by a plurality of mutually independently operable propulsion units, each including an extended leg coupled with the frame of the vehicle. The vehicle is propelled through a selectively operable power train functioning to drive the leg in rotation about its axis and/or activating the pedestal in a wheel-driven and/or track-laying mode of operation. Official Gazette of the U.S. Patent Office

N73-26239# Advisory Group for Aerospace Research and Development, Paris (France).
PROBLEMS IN WIND TUNNEL TESTING TECHNIQUES
Apr. 1973 165 p refs
(AGARD-R-601; AGARD-601) Avail: NTIS HC $10.25

The design and operation of large wind tunnels for low speed and transonic speed conditions are described. The subjects discussed include the following: (1) methods for correcting wall constraints in transonic wind tunnels, (2) interference effects of model support systems, (3) minimum required measuring times to perform instationary measurements in transonic tunnels, (4) wind tunnel requirements for helicopters, and (5) acoustic considerations for noise experiments at model scale in subsonic wind tunnels. For individual titles, see N73-26240 through N73-26247.

N73-26240 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
REVIEW OF SOME PROBLEMS RELATED TO THE DESIGN AND OPERATION OF LOW SPEED WIND TUNNELS FOR V/STOL TESTING
Mario Carbonaro *In* AGARD Probl. in Wind Tunnel Testing Tech. Apr. 1973 24 p refs (For availability see N73-26239 17-11)

A review is made of a number of operational problems associated with the wind tunnel testing of V/STOL aircraft including helicopters. The following subjects are discussed: (1) wall constraints, (2) use of ventilated walls, (3) testing for ground effect, and (4) flow disturbances in the tunnel circuit. Mathematical models are developed to clarify the theoretical aspects of wind tunnel operation. Author

N73-26241 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France). Aerodynamics Dept.
SURVEY OF METHODS FOR CORRECTING WALL CONSTRAINTS IN TRANSONIC WIND TUNNELS
Jean-Ch. Vayssaire *In* AGARD Probl. in Wind Tunnel Testing Tech. Apr. 1973 48 p refs (For availability see N73-26239 17-11)

The use of ventilated walls in transonic wind tunnels and the effect on wall interference corrections are discussed. Mathematical applications of the extreme cases of zero permeability and infinite permeability are examined. The solutions are compared and the characteristics of theoretical working sections are analyzed. Mathematical models are provided to support the theoretical considerations. Author

N73-26242 Aircraft Research Association, Ltd., Bedford (England).
INTERFERENCE EFFECTS OF MODEL SUPPORT SYSTEMS
E. C. Carter *In* AGARD Probl. in Wind Tunnel Testing Tech. Apr. 1973 10 p refs (For availability see N73-26239 17-11)

The forms of interference occurring in subsonic and transonic wind tunnels due to model support systems are discussed. Two types of model attachment, rear sting and vertical blade sting are considered and the form and magnitude of interference terms are given for some particular examples. The buoyancy interference in the working section due to a typical sting joint and roll mechanism behind a model is considered and the effect on drag is evaluated for two typical bodies. Author

N73-26243 Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
MINIMUM REQUIRED MEASURING TIMES TO PERFORM INSTATIONARY MEASUREMENTS IN TRANSONIC WIND TUNNELS
J. W. G. VanNunen, G. Coupry (ONERA, Chatillon-sous-Bagneux, France), and H. Foersching (DFVLR, Goettingen, West Germany) *In* AGARD Probl. in Wind Tunnel Testing Tech. Apr. 1973 2 p refs (For availability see N73-26239 17-11)

The minimum required run times for instationary measurements at transonic speeds during wind tunnel tests are analyzed. The subjects discussed are: (1) instationary pressure measurement techniques, (2) flutter tests, (3) buffet measurements, and (4) cross correlation techniques. It is concluded that present test methods require a minimum running time of ten seconds. It is suggested that new test techniques may reduce the time requirement. Author

N73-26244 Royal Aircraft Establishment, Bedford (England).
SOME CONSIDERATIONS OF TESTS UNDER DYNAMIC CONDITIONS IN LOW SPEED WIND TUNNELS
D. N. Foster *In* AGARD Probl. in Wind Tunnel Testing Tech. Apr. 1973 4 p refs (For availability see N73-26239 17-11)

The objectives of dynamic tests conducted in low speed wind tunnels are examined. For a number of specific problems for measurements under static conditions it is possible that special techniques and new equipment will be required. The two general areas of consideration are: (1) measurement of oscillatory derivatives and (2) measurement of transient motions caused by gusts and ground effect. It is concluded that the main requirements for data relevant to dynamic effects can be met under static conditions over a wide range of variables. Author

N73-26245 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Aerodynamische Versuchsanstalt.
USE OF MODEL ENGINES (V/S/CTOL)
E. Melzer and R. Wulf *In* AGARD Probl. in Wind Tunnel Testing Tech. Apr. 1973 17 p refs (For availability see N73-26239 17-11)

The special conditions required to conduct wind tunnel tests of jet aircraft engines are examined. The capabilities for simulation in atmospheric tunnels are discussed. The problems of testing in pressurized tunnels are analyzed. An estimation of the energy, the plants, and the test equipment required for engine simulation are listed. Author

N73-26246 Westland Helicopters, Ltd., Yeouil (England).
WIND TUNNEL REQUIREMENTS FOR HELICOPTERS
I. A. Simons and H. Derschmidt (MBB, Munich) *In* AGARD Probl. in Wind Tunnel Testing Tech. Apr. 1973 10 p refs (For availability see N73-26239 17-11)

The sizes of model which are most suited to various aspects of wind tunnel tests of helicopters are defined. The scaling laws and associated constructional problems of small scale rotor systems are discussed. Tunnel sizes are suggested for various ranges of model size based on a consideration of interference effects. Author

N73-26247 Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.
ACOUSTIC CONSIDERATIONS FOR NOISE EXPERIMENTS AT MODEL SCALE IN SUBSONIC WIND TUNNELS
T. A. Holbeche and J. Williams *In* AGARD Probl. in Wind Tunnel Testing Tech. Apr. 1973 30 p refs (For availability see N73-26239 17-11)

Acoustic considerations for noise experiments at model scale in subsonic wind tunnels are presented. Emphasis is placed on similarity to flight test conditions, noise measurement constraints on model and tunnel sizes, the parasitic effects of background noise, and the various factors contributing to the generation of noise. The specific contributions to tunnel noise from the tunnel drive fan, the tunnel circuit, the test section mainstream flow, and the particular test section boundary conditions are discussed. Author

N73-26248# National Aviation Facilities Experimental Center, Atlantic City, N.J.
DIGITAL SIMULATION FACILITY/SYSTEM SUPPORT FACILITY INTERFACE TESTS Final Report, Jan. - Oct. 1972
R. R. Reyers Jul. 1973 35 p
(FAA-NA-73-33; FAA-RD-73-67) Avail: NTIS HC $3.75

A series of tests was conducted to interface the Digital Simulation Facility (DSF) with the System Support Facility (SSF) at the National Aviation Facilities Experimental Center (NAFEC). Included were tests of the DSF performance, as well as tests of the hardware interface to the 9020 computer, and the software interface to the NAS Model 3dl program. This report describes these tests and the results obtained. Author

N73-26249+ Royal Aircraft Establishment, Farnborough (England).
NOISE MEASUREMENTS IN THE MODANE LARGE WIND-TUNNEL
Curt Broll 1973 14 p refs Transl. into ENGLISH from la Rech. Aerospatiale (Paris), v. 1, 1972 p 47-51
(RAE-Lib-Trans-1683; BR35413) Copyright. Avail: NTIS HC $3.00

Noise measurements made on a helicopter rotor in a wind tunnel are described. The acoustic calibration measurements made with the wind-on and wind-off in an empty tunnel are described. The helicopter noise results are corrected for reverberation and amplification effects in the acoustically untreated test section by the simple application of some comparative control measurements of the noise from a basic source at the rotor location in the tunnel wind-off and free-field conditions outside. Author

N73-26250# Royal Aircraft Establishment, Farnborough (England).
A CONTROLLER FOR RANDOM AND CONSTANT AMPLITUDE LOADING ON RESONANT AND ELECTROHYDRAULIC FATIGUE MACHINES
P. R. Edwards Mar. 1973 33 p refs
(RAE-TR-72226; BR-34374) Avail: NTIS HC $3.75 CSCL 14B

A Schenck resonant fatigue machine is described which has been modified to apply Gaussian narrow band random loading. A detailed description is given of the control system which controls constant amplitude loads by varying the frequency of the machine excitation signal and controls random loads by varying the amplitude of the excitation signal. It is described how the controller has also been used to control random and constant amplitude loading on an Amsler Vibrophore and on electrohydraulic fatigue machines. Author

N73-26251# Operations Research, Inc., Silver Spring, Md.
A GUIDE TO ASSESS THE OPERATIONAL IMPLICATIONS OF NEW SHIP DESIGN CONCEPTS, PART 2 Interim Report
Ernest L. Holmboe and Allen D. Evans 22 Mar. 1973 118 p refs
(Contract N00014-70-C-0426; NR Proj. 274-121; RF0180206) (AD-759376; ORI-TR-741-Pt-2; IR-2) Avail: NTIS CSCL 13/10

The report is the second interim report on ONR-sponsored research to develop analytical methods for the evaluation of future high-performance ship design concepts. In the report, a demonstration of selected analytical techniques is described for a hydrofoil concept to be employed in the general ASW mission area. A deterministic computer model was developed to accept

basic platform design parameters and compute the platform's ability to conduct a specific mission profile. Extensive sensitivity analyses are included (for demonstration purposes) and evaluated for utility in concept evaluation. Emphasis is placed on the adaptability of the approach to other concepts and other parametric design models. (Author Modified Abstract) GRA

N73-26252*# Computer Sciences Corp., Huntsville, Ala.
MARSHALL SYSTEM FOR AEROSPACE SYSTEM SIMULATION (MARSYAS), USER'S MANUAL
A. Ventre, R. Sevigny, W. McCollum, and T. Balentine 1 Jul. 1973 178 p refs
(Contract NAS8-21805)
(NASA-CR-124288; TR-1) Avail: NTIS HC $11.00 CSCL 14B

The capabilities of the Marshall system for aerospace system simulation (MARSYAS) and how to use it are described. MARSYAS is a software system that allows easy setup and control of the simulation of the dynamics of large physical systems on a digital computer. The physical systems are modeled in the form of block diagrams or equations. The blocks can have multiple inputs and multiple outputs, and they can be nested to form hierarchies. The block diagrams can contain transfer functions, nonlinear and logcal functions, equations, analog computer elements and FORTRAN programs. The input format of the equations can be combinations of nonlinear, time-varying differential equations and algebraic equations in their original format. MARSYAS could also serve as a storage and retrieval system for models as a basis for a model configuration control system on a central time-shared computer. The outputs of the simulation system can be not only time-responses but also other analysis data such as frequency response, power spectrum and stability parameters. The MARSYAS translator is written in FORTRAN running on the Univac 1108 computer under the EXEC 8 operating system. Author

N73-26253# Federal Aviation Administration, Washington, D.C. Office of Aviation Policy and Plans.
AN EVALUATION STUDY OF THE AIRPORT DEVELOPMENT-AID PROGRAM, FY 1971 - 1972 Final Report
Raymond T. Uhl Sep. 1972 256 p
(FAA-AV-72-4) Avail: NTIS HC $15.00

This report reviews and analyzes air carrier/reliever airport grant allocations made in the first two years of the operation of the Airport Development-aid Program (Fiscal Years 1971-1972) in an attempt to determine the effectiveness of the program. In doing so, it looks at the nature of aeronautical demand, national airport system requirements, reviews ADAP program procedures, and analyzes the characteristics of airport grant allocations. Finally, the report considers the program with respect to congestion relief and suggests potential program adjustments to increase the effectiveness of the program. Author

N73-26254# Naval Weapons Center, China Lake, Calif.
FIELD EVALUATION OF AN ELECTROGASDYNAMIC FOG DISPERSAL CONCEPT, PARTS 1 AND 2 Final Report, 10 Jul. 1973 - 31 Jan. 1973 - 31 Jan. 1973
Ta-Kuan Chiang (Gourdine Systems, Inc., Livingston, N. J.), M. C. Gourdine (Gourdine Systems, Inc., Livington, N.J.), T. Wright, and R. Clark Feb. 1973 142 p refs
(Contracts DOT-FA72WAI-318; DOT-FA72WAI-316)
(FAA-RD-73-33-Pt-1-Pt-2) Avail: NTIS HC $9.25

An electrogasdynamic concept of fog dispersal was field tested on fogs in the Panama Canal Zone. Qualitative visibility improvements were obtained in those experiments where field apparatus functioned as proposed. Quantitatively, the space-charge density and induced electric fields created by the technique were of the right order of magnitude as predicted by the model. Ten fog dispersal tests, employing 16 electrogasdynamic spray gun units, were also conducted in the Panama Canal Zone. Two of the tests could not be evaluated because of equipment malfunction and natural fog dissipation. Results from the remaining tests showed that while clearing trends were achieved during six out of eight tests, the magnitude and persistence of visibility improvement as well as the time to achieve such improvement varied widely from test to test. Author

N73-26255# Douglas Aircraft Co., Inc., Long Beach, Calif.
PROCEDURES FOR DETERMINATION OF AIRPORT CAPACITY, APPENDICES, VOLUME 2 Interim Report, Jun. 1972 - Jan. 1973
Apr. 1973 298 p Prepared in cooperation with McDonnell Douglas Automation Co., Peat, Marwick, Mitchell and Co., and Am. Airlines, Inc.
(Contract DOT-FA72WA-2897)
(FAA-RD-73-11-Vol-2) Avail: NTIS HC $17.00

Appendices are presented in support of the efforts undertaken in three major areas. These are: (1) The airport planning studies task was a user oriented effort to define the requirements for planning tools. Surveys of potential users were made which helped define the format for the planned Capacity Handbook. Definitions of airfield capacity and delay were refined. (2) Data collection involved gathering operational information relating to airfield performance at 14 U.S. airports. (3) Models for determining airfield capacity and delay were also developed. For computational efficiency it was decided to use analytical techniques for capacity determination. However, the delay model necessarily had to use Monte Carlo simulation, and the appropriate logic was developed. Author

N73-26256*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REAR STEERING INOPERATIVE: APOLLO 16 MISSION Anomaly Report No. 10
Jan. 1973 6 p refs
(NASA-TM-X-69198; MSC-07683) Avail: NTIS HC $3.00 CSCL 13F

The inoperative condition of the rear steering system of the lunar roving vehicle (Apollo 16) during the initial drive to the modular equipment stowage assembly was investigated. The front and rear steering systems are described, and the failure analyzed. It is concluded that an open circuit must have occurred either in the hand controller potentiometer or between the potentiometer wiper and the summing node. F.O.S.

N73-26257# Los Alamos Scientific Lab., N.Mex.
MAGNETIZATION CURVES OF SUPERCONDUCTORS: TYPE 1, TYPE 2, AND TYPE 3
B. T. Matthias Nov. 1972 441 p refs Proc. of the 1972 Proton Linear Accelerator Conf., Los Alamos, N. Mex., 10-13 Oct. 1972
(LA-5115) Avail: NTIS

The Meissner effect in both ac and dc applications in Types I, II, and III superconductors is discussed. Magnetization curves are given. NSA

N73-26258# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
BUNCH LENGTHENING AND POWER LOSSES DUE TO THE VACUUM CHAMBER WALLS
A. Piwinski Dec. 1972 26 p refs
(DESY-72/72) Avail: AEC Depository Libraries

The longitudinal field induced by a bunched beam in a metallic or ceramic vacuum chamber was investigated. The resulting power losses and the bunch lengthening was calculated for high energies and a limit for the stability of the phase oscillations was derived. Author (NSA)

N73-26259# Colorado Univ., Boulder. Dept. of Physics and Astrophysics.
[RESEARCH PROGRESS IN NUCLEAR AND INTERMEDIATE ENERGY PHYSICS, ALONG WITH THE THEORETICAL PROGRAM] Technical Progress Report, 1 Nov. 1971 - 1 Nov. 1972
1 Nov. 1972 137 p refs
(Contract AT(11-1)-535)
(COO-535-674) Avail: NTIS

The research activities in physics are reported. Topics discussed include proton and helium-3 reactions with various elements. Energy levels for various elements are also presented. F.O.S.

N73-26260# Los Alamos Scientific Lab., N.Mex.
DENSITY PROFILES OF A SUPERSONIC JET TARGET
J. E. Brolley 1972 4 p refs Presented at the 5th Particle

Accelerator Conf., San Francisco, 5 Mar. 1973
(Contract W-7405-eng-36)
(LA-UR-73-231; Conf-730310) Avail: NTIS

A supersonic jet target of H2(D2) having an areal density of 5 x 10 to the 7th power protons/sq cm and 360 deg access in vacuum has been fabricated for use on the LAMPF NPL beam. Author (NSA)

N73-26261# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
[ACTIVITIES OF THE LABORATOIRE D'ASTRONOMIE SPATIALE] Annual Report, 1971 - 1972 [RAPPORT D'ACTIVITE DU L.A.S. 1971 - 1972]
15 Sep. 1972 157 p refs In FRENCH
(RAP-01-72) Avail: NTIS HC $10.00

The activities of the Laboratoire d'Astronomie Spatiale (LAS) during the year 1971 to 1972 are presented. They include CEPHEE, TD-2, Faust, and Janus experiments as well as the work performed at the absolute calibration, optics, electronics, library departments. ESRO

N73-26262# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
DIFFICULITES DURING THE BAROMETRIC DISCHARGING OF LIQUIDS FROM THE VACUUM BY MEANS OF GRAVITY TUBES [SCHWIERIGKEITEN BEIM BAROMETRISCHEN AUSSCHLEUSEN VON FLUESSIGKEITEN AUS DEM VAKUUM MITTELS FALLROHREN]
Heinrich Lambrecht 15 Jan. 1973 29 p refs IN GERMAN; ENGLISH summary
(DLR-Mitt-73-10) Avail: NTIS HC $3.50; DFVLR Porz-Wahn: 11,50 DM

The barometric discharging of liquid, used to cool rocket exhaust gases by means of gravity tubes, and its efficiency improvement by means of an air vent, is discussed. This cooling system is used at rocket test stands, and the cooling of the exhaust gases is obtained by passing the gases through a liquid spray. Unexpectedly high inflow heights can result during the barometric discharging of these liquids by means of gravity tubes. By applying a pipe venting system low inflow heights can be achieved for the same geometric dimensions. The efficiency of this venting system was demonstrated by experiments with a spray cooler for rocket exhaust gases. ESRO

N73-26263*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL DETERMINATION OF A LINEAR THE COMPRESSIVE BEHAVIOR OF A LINEAR INDUCTION MOTOR REACTION RAIL Technical Paper, Feb. - May 1972
E. C. Haight, W. A. Hutchens, and J. G. Williams 1 Nov. 1972 82 p Prepared by Mitre Corp., McLean, Va.
(Contract DOT-FR-7-35248)
(NASA-TM-X-69276; PB-214506/8; MTP-374) Avail: NTIS HC $3.00 CSCL 13F

The reaction rail provides guidance for and reacts the thrust of the motor in the Department of Transportation's Linear Induction Motor Research Vehicle (LIMRV). The tests described in this paper provide data which lead to the understanding of the behavior of the rail in compression. Tests were performed to determine the buckling load and buckling mode shape, the effect of initial inperfections on static lateral stability, and the effect of compressive forces on rail lateral stiffness. Included is a recommendation for an improved field installation.
Author (GRA)

N73-26264# Illinois Univ., Savoy.
SIMULATOR MOTION IN AVIATION SYSTEM DESIGN RESEARCH
Robert C. Williges and Stanley N. Roscoe May 1973 28 p refs Presented at the NATO seminar on Man Machine Relations, Utrecht, Netherlands, 28-30 May 1973
(Contracts N00014-67-A-0305-0014; F44620-70-C-0105)
(AD-760049; ARL-73-6/ONR-73-2/AFOSR-73-3) Avail: NTIS CSCL 01/4

In three studies, the order of merit of four flight-director/attitude-indicator displays (moving horizon, moving airplane, frequency-separated, and kinalog) was assessed under three conditions of simulator motion (no motion, normal GAT-2 simulator motion, and washout motion), and the results were compared to flight performance. Comparisons among the studies were made to determine whether or not performance on various display modes was differentially affected by simulator motion cues, and if so, what degrees and fidelity of simulator motion were required to produce results that generalized to flight performance. It was concluded that the presence or absence of motion cannot only affect absolute levels of performance, but different orders of merit among displays can occur. Specifically, inappropriate cockpit motion may be more misleading than no motion, whereas limited motion in pitch and roll that corresponds closely to the angular accelerations encountered in flight may be sufficient to produce generalizable research data on the relative merits of flight displays. (Author Modified Abstract) GRA

N73-26265# Physics International Co., San Leandro, Calif.
INTENSE ELECTRON BEAM GENERATION, TRANSPORT, AND DIAGNOSIS
Sidney Putnam, Philip Spence, James Benford, Bruce Ecker, Charles Stallings, John Guillory, Donald Pellinen, Don Wood, and John Creedon May 1973 276 p refs
(Contracts DASA01-70-C-0063; DASA01-71-C-0052)
(AD-760038; PIFR-227/294; DNA-2787F) Avail: NTIS CSCL 20/7

The report describes intense electron beam generation, transport, and diagnosis oriented toward the development of technology required for construction of an advanced X-ray source. Generation and transport of beams was performed both with and without externally applied magnetic fields; (azimuthal, B(theta), and longitudinal, B(z), magnetic fields were employed). Electron beam and X-ray diagnostics developed or modified for use in this work are described along with theoretical work on diode and beam transport phenomena. Author (GRA)

N73-26266# Maxwell Labs., Inc., San Diego, Calif.
BLACKJACK 2 PROPAGATION AND MERGING OF HIGH CURRENT RELATIVISTIC ELECTRON BEAMS Final Report
Alan C. Kolb, Clyde B. Dobbie, Richard A. Miller et al Apr. 1973 100 p
(Contract DASA01-70-C-0045)
(AD-760344; MLR-140; DNA-NWER-XAXL) Avail: NTIS CSCL 20/7

A facility with two low-impedance water dielectric coaxial pulse line electron accelerators has been constructed. The coaxial pulse lines are water filled and synchronized for operation to within plus or minus 2 ns. A beam transport system, with the capability of magnetic compression system is used to drift and merge the two electron beams. High current density (j = 30 kA/cm squared) beams have been transported over distances of 1.3 m with transport efficiencies in excess of 80 percent. Compression ratio of 2 - 5:1 have been achieved, and current densities in the 50 - 100 kA/cm squared range are confirmed by carbon calorimeter and radiation measurements.
Author (GRA)

N73-26267# Massachusetts Inst. of Tech., Cambridge.
SIMULATOR EVALUATION OF PILOT ASSURANCE DERIVED FROM AN AIRBORNE TRAFFIC SITUATION DISPLAY Final Report, 1 Jul. 1971 - 28 Feb. 1972
Jack D. Howell Feb. 1972 170 p refs
(Contracts F19628-70-C-2301; DOT-FA71WAI-234)
(AD-749280; FAA-EM-72-3) Avail: NTIS CSCL 01/5

An extensive series of tests were run on a transport cockpit simulation facility to evaluate the pilot assurance value of airborne displays used as traffic situation monitors in high-density terminal airspace. The twenty professional pilots employed as subjects were exposed to a set of typical normal and abnormal terminal approach situations. Their level of assurance was determined from their detailed knowledge of each situation, measured by stop-action quizzes, and the ability to detect conflicts. Workload or the degree of difficulty the pilots experienced in acquiring relevant information about the situation was also regarded as a component of assurance. Specific problem areas emphasized in the test scenarios were simultaneous approaches to closely-spaced parallel runways, blunder detection and

resolution, and providing a picture for the pilot when discrete address data links replace current ATC party-line communications. Author (GRA)

N73-26282 Royal Aircraft Establishment, Bedford (England).
THE NEED FOR HIGH-REYNOLDS-NUMBER TRANSONIC TUNNELS
C. R. Taylor *In* AGARD Fluid Motion Probl. in Wind Tunnel Design Apr. 1973 13 p refs (For availability see N73-26279 17-12)

N73-26285 City Univ., London (England). Dept. of Aeronautics.
DESIGN OF VENTILATED WALLS WITH SPECIAL EMPHASIS ON THE ASPECT OF NOISE GENERATION
R. N. Cox and M. M. Freestone *In* AGARD Fluid Motion Probl. in Wind Tunnel Design Apr. 1973 7 p refs (For availability see N73-26279 17-12)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-26268 Utah State Univ., Logan.
AN ALTERNATING DIRECTION RELAXATION SCHEME FOR COMPUTING INVISCID TWO DIMENSIONAL TRANSONIC FLOWS THROUGH CASCADES Ph.D. Thesis
Clayton Stewart Miller 1972 98 p
Avail: Univ. Microfilms Order No. 73-903

Numerical solutions of the nonlinear total velocity potential equation were obtained by extending the alternating direction implicit (ADI) relaxation method for the case of two-dimensional, steady, inviscid transonic flow through a cascade of airfoils. The technique presented here demonstrated that the ADI method can be modified so as to be applicable to hyperbolic (supersonic) as well as elliptic (subsonic) regions. Solutions were obtained by applying central and backward differencing to the locally linearized nonlinear equation in subsonic and supersonic flow regions, respectively, and a spectral algorithm for implicit calculations in mixed elliptic-hyperbolic regions was developed. Dissert. Abstr.

N73-26269 Delaware Univ., Newark.
THE INSTABILITY OF SUPERPOSED FLOW Ph.D. Thesis
Shaw Shyong Liang 1972 84 p
Avail: Univ. Microfilms Order No. 72-32002

Two problems are studied. The first problem considers the stability of an idealized atmosphere blowing over an inviscid liquid. An idealized atmosphere is a fluid with exponentially decreasing density in the stationary state. By liquid it is meant that the fluid is incompressible and the disturbances at its free surface can be seen in the form of water waves. The second problem considers the stability of a perfect gas blowing over an inviscid liquid. All the velocity profiles are assumed to be uniform in stationary state. The basic idea and the basic equations are carefully investigated. Different methods of stability analysis are used for different problems. It is shown that an upper solid boundary can actually eliminate the initial instability in the first problem. For the second problem, it is found that the critical velocity is reduced by the compressibility effect in a subsonic flow, and the system is always unstable for a supersonic flow. Dissert. Abstr.

N73-26270 Minnesota Univ., Minneapolis.
CONTRIBUTIONS TO LINEAR STABILITY THEORY OF NEARLY PARALLEL FLOWS Ph.D. Thesis
Skjalg Erling Haaland 1972 182 p
Avail: Univ. Microfilms Order No. 73-1015

The effect of the streamwise coordinate of the basic flow on the stability characteristics of boundary layer flows is discussed. It is found that the usual Orr-Sommerfeld equation is a nonuniform approximation to the disturbance equation for the class of flows for which the streamwise velocity approaches zero in the free stream. It is also found that the transverse velocity is inward directed and approaches a nonzero function. For this class of flows, it is shown that not only is the vorticity of the basic flow contained within the boundary layer, but also the disturbance vorticity as well. Dissert. Abstr.

N73-26271 State Univ. of New York, Stony Brook.
EXPERIMENTAL STUDY OF LAMINAR BOUNDARY LAYER AND OSCILLATORY SUSPENSION FLOWS BY LASER ANEMOMETRY Ph.D. Thesis
Shmuel Einav 1972 188 p
Avail: Univ. Microfilms Order No. 72-31643

An experimental investigation is made of the behavior of two flow fields: a laminar boundary layer of a suspension over a flat plate, and an oscillatory flow of a suspension in a tube. A water channel and an oscillatory flow system were designed and built. Velocity fields of both the fluid and the solid spherical particles and the density field of the solid particles are simultaneously obtained by the use of a two-dimensional Laser-Doppler anemometer. The flow field over the flat plate is investigated for the intermediate region and the far downstream region of the boundary layer. It is observed that the slip in velocity between the two phases is larger near the wall, and one way migration of particles exists in both regions and is directed towards the outer edge of the boundary layer. The oscillatory flow field of a suspension in a tube was found to be more complex, as the migratory effects and the equilibrium radial positions depend not only on the particle size and concentration but also on the frequency parameter. Dissert. Abstr.

N73-26272 University of Southern Calif., Los Angeles.
HELIUM CONCENTRATION MEASUREMENTS UTILIZING LASER INDUCED RAMAN SCATTERING Ph.D. Thesis
Morton Meyer Glick 1972 123 p
Avail: Univ. Microfilms Order No. 73-737

A technique which requires the monitoring of laser induced Raman scattered light from gas molecules was developed for measuring density in a mass diffusing jet. The validity of this method, which does not disturb the flow field, is demonstrated by applying it to an air-helium turbulent jet to measure the mean density profiles and by showing that, based upon the empirical data, the mass balance of the helium specie can be completed to within + or - 5 percent at several stations. In addition, the corresponding pressure and velocity profiles in the jet are presented along with estimates of the laser power necessary to make time-resolved measurements in the above flow field. Dissert. Abstr.

N73-26273 New Mexico Univ., Albuquerque.
NUMERICAL TECHNIQUES AND SOLUTIONS FOR AXISYMMETRICAL VISCOUS COMPRESSIBLE FLOWS Ph.D. Thesis
Kenneth Wayne Smith 1972 175 p
Avail: Univ. Microfilms Order No. 73-1556

Numerical techniques for solving axisymmetrical, viscous, compressible flow around blunt bodies are developed. Solutions were limited to systems of ideal gases with laminar unseparated boundary layers. The bow wave was represented by a moving discontinuity. The remainder of the system was represented by second order accuracy time dependent difference equations. In this investigation the difference equations were derived from basic time dependent, viscous compressible flow equations that were transformed into body related coordinates. In a development phase, many numerical techniques were tested on digital computers before adopting the ones that were used in obtaining the results that are presented. The addition of stabilizing terms to basic difference equations was used to achieve numerical stability. Numerical experiments were performed to minimize the effect of the stabilizing terms on the results. Dissert. Abstr.

N73-26274 Minnesota Univ., Minneapolis.
STRUCTURE OF TURBULENT JETS AND WAKES USING EDDY VISCOSITY MODELS Ph.D. Thesis
Francis Cheng-ping Wang 1972 90 p
Avail: Univ. Microfilms Order No. 73-1071

The structure of incompressible turbulent flows in a plane wake and a plane jet are investigated using two eddy viscosity models. The equations for the mean motion are derived from

the Navier-Stokes equations for a viscous fluid by decomposing the motion into a mean and fluctuating part. The resulting equations introduce the Reynolds stress. The Reynolds stress is related to its contracted part, the turbulent energy, and the mean velocity gradient by a scalar eddy viscosity. The equation for the turbulent energy is also derived in the same way. It gives a detailed balance of turbulent energy among its different entities - production, advection, diffusion, and dissipation. These equations can be closed by using hypothetical relations for the turbulent transport process and dissipation. Dissert. Abstr.

N73-26275 Newark Coll. of Engineering, N.J.
THE EFFECT OF VARIABLE PROPERTIES ON THE LAMINAR FLOW OF GASES IN CYLINDRICAL TUBES AT LOW WALL TO BULK TEMPERATURE RATIOS Ph.D. Thesis
Norman Zethward Shilling 1972 342 p
Avail: Univ. Microfilms Order No. 72-26337

The problem of heat transfer in laminar flow of a gas through a constant diameter cylindrical tube is treated. The gas is cooled by the tube walls held at constant temperature. Two tube inlet conditions are considered: (1) fully developed velocity and uniform temperature profiles (Graetz boundary condition) and (2) uniform velocity and temperature (UTV) profiles. Results of the theoretical and experimental phases of the work are presented. The theoretical solution is based on the compressible boundary layer equations with varying transport and thermodynamic property terms retained. For the Graetz condition, an existing finite difference solution scheme is modified for improved prediction of gradients at the wall. For the UTV condition, a combined analytical-numerical solution scheme is utilized. Dissert. Abstr.

N73-26276 Pennsylvania State Univ., University Park.
NON-ISOTHERMAL GASEOUS FLOW THROUGH FINE PORED MEDIA Ph.D. Thesis
Mason Harold Somerville 1972 158 p
Avail: Univ. Microfilms Order No. 72-33206

A model of nonisothermal gaseous flow through fine pored homogeneous media is presented. The model consists of two parts: a probabilistic model of the porous medium and a description of the three flow regimes: continuum, slip and free molecule. The pore size distributions of the media used were determined by mercury penetration tests and by a new technique utilizing a Scanning Electron Microscope (SEM). The median pore diameters determined by the two techniques were similar (1.35 microns and 1.90 microns); however, the cumulative pore areas differed by an order of magnitude. This discrepancy was attributed to pores filled during SEM sample. Dissert. Abstr.

N73-26277 Cornell Univ., Ithaca, N.Y.
REFLECTION OF A WEAK SHOCK WAVE WITH VIBRATIONAL RELAXATION FROM A WALL Ph.D. Thesis
Ching-Mao Hung 1972 97 p
Avail: Univ. Microfilms Order No. 73-347

The structure of a shock wave in a vibrationally relaxing gas undergoing reflection from a plane wall is examined. The shock wave is assumed to be weak and departures from thermodynamic equilibrium are assumed small. Both an adiabatic and an isothermal wall are considered. The flow field is divided into three regions: a far-field region, an interaction region, and, for the isothermal wall case, a thermal boundary layer. Different asymptotic expansions are determined for the various regions through the method of matched asymptotic expansions. In the region far from the wall, a nonequilibrium Burgers equation governing the incident and the reflected shock wave structures is derived. Dissert. Abstr.

N73-26278 Cincinnati Univ., Ohio.
THE DYNAMIC CHARACTERISTICS OF SOLID PARTICLES IN PARTICULATE FLOW IN ROTATING TURBOMACHINERY Ph.D. Thesis
M. Fathy Hussein 1972 149 p
Avail: Univ. Microfilms Order No. 73-1211

The dynamic characteristics of a group of solid particles through a turbine stage and a one and one half compressor stage are calculated by solving the equations of motion of the particles for all the successive rows of the turbine and the compressor. By the dynamic characteristics of the solid particles it is meant the particles' three-dimensional absolute trajectories, their trajectories relative to the rotor, their velocities distributions throughout the cascade rows, and their velocity diagrams as compared to that of the gas for every stage. The effect of the different flow parameters, namely the particles mean diameter, their solid material density, particles and gas initial velocities, and the ratio between rotor off-design rotational speed to its design value on the dynamic characteristics of the solid particles in the cascades of the turbine and the compressor are investigated. Observations concerning the areas of the stator or the rotor blades of the turbine or the compressor that are subjected to a concentrated and a higher frequency of collisions, and hence subjected to higher erosion rates, are presented. Dissert. Abstr.

N73-26279# Advisory Group for Aerospace Research and Development, Paris (France). Fluid Dynamics Panel.
FLUID MOTION PROBLEMS IN WIND TUNNEL DESIGN
Apr. 1973 68 p refs
(AGARD-R-602; AGARD-602) Avail: NTIS HC $5.50

A series of research papers is presented relating to the design and operation of low speed and transonic wind tunnels with particular emphasis on the associated fluid motion problems. For individual titles, see N73-26280 through N73-26285.

N73-26280 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
THE INFLUENCE OF THE FREE-STREAM REYNOLDS NUMBER ON TRANSITION IN THE BOUNDARY LAYER ON AN INFINITE SWEPT WING
E. H. Hirschel *In* AGARD Fluid Motion Probl. in Wind Tunnel Design Apr. 1973 11 p refs (For availability see N73-26279 17-12)

The three-dimensional compressible laminar boundary layer on an infinite swept wing at different sweep angles is calculated and stability and transition criteria are applied to it for free-stream Reynolds numbers ranging from values possible nowadays in transonic wind tunnels to values typically for full-scale flight. The distribution of the inviscid flow is taken from experiments on airfoils, and exhibits for subsonic free stream Mach numbers supersonic regions terminating in shock waves at about 20 percent chord length. Results are given for four different wing sections. The techniques employed and their shortcomings are discussed. Author

N73-26281 Royal Aircraft Establishment, Farnborough (England).
SOME EXAMPLES OF THE APPLICATION OF METHODS FOR THE PREDICTION OF BOUNDARY-LAYER TRANSITION ON SHEARED WINGS
D. A. Treadgold and J. A. Beasley *In* AGARD Fluid Motion Probl. in Wind Tunnel Design Apr. 1973 1 p refs (For availability see N73-26279 17-12)

The laminar boundary layer was calculated for the leading-edge region of four selected airfoils for cases where the supercritical region is terminated by a shock wave at about 20% chord. The possibility of the boundary layer becoming turbulent before the shock wave is then considered according to four different criteria: leading-edge contamination, relaminarisation, sweep instability, and Tollmien-Schlichting instability. Many simplifying assumptions have had to be made, since the purpose of the report is to demonstrate how the problem might be treated, rather than to present difinitive results, and how the various mechanisms are seen in conjunction. It is concluded that much more needs to be known before predictions can be made confidently with any degree of precision. Author

N73-26282 Royal Aircraft Establishment, Bedford (England).
THE NEED FOR HIGH-REYNOLDS-NUMBER TRANSONIC TUNNELS c11
C. R. Taylor *In* AGARD Fluid Motion Probl. in Wind Tunnel Design Apr. 1973 13 p refs (For availability see N73-26279 17-12)

The present generation of transonic tunnels cannot simulate full-scale flows at critical points of the flight enveloped for many current aircraft designs and there is an urgent need for new tunnels which would permit model tests to be made at much higher Reynolds numbers. New tunnels are proposed that would

allow good simulations of aircraft shape to be made for a wide range of model tests; this limits the maximum tunnel total pressure to about 8 bars. A Reynolds number range which covers about half the full-scale range is advocated, demanding a working section area of about 25m squared. The tunnels would have low levels of free-stream turbulence and be capable of operation under conditions giving little heat transfer to the model. Running times of at least 10 sec are required. Author

N73-26283 Royal Aircraft Establishment, Bedford (England).
ON THE INFLUENCE OF FREE-STREAM TURBULENCE ON A TURBULENT BOUNDARY LAYER, AS IT RELATES TO WIND TUNNEL TESTING AT SUBSONIC SPEEDS
J. E. Green *In* AGARD Fluid Motion Probl. in Wind Tunnel Design Apr. 1973 8 p refs (For availability see N73-26279 17-12)

Published experimental measurements are reviewed which show the turbulent boundary layer to be highly sensitive to turbulence in the free-stream. In zero pressure gradient, a small increase in the streamwise rms velocity fluctuation is found to have the same effect on the shape of the velocity profile as a fractional increase in Reynolds number roughly sixty times as great. It is concluded that this effect needs to be taken into account in planning new wind tunnels for subsonic and transonic testing at high Reynolds number. Further experimental work is needed to clarify: the importance of turbulence scale, the influence of pressure gradients, and influence of radiated pressure (as opposed to convected vorticity) fluctuations. Author

N73-26284 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
EFFECTS OF TURBULENCE AND NOISE ON WIND TUNNEL MEASUREMENTS AT TRANSONIC SPEEDS
Adalbert Timme *In* AGARD Fluid Motion Probl. in Wind Tunnel Design Apr. 1973 12 p refs (For availability see N73-26279 17-12)

Current knowledge is reviewed of the effects of flow unsteadiness on steady and dynamic measurements on models in wind tunnels at transonic speeds. It is found that in most cases the influence of the pressure or velocity fluctuations on flow patterns such as boundary layers with transition or separation, bubble flow or shock interaction is quantitatively known from experiments only for particular parameter combinations. No universal information about the turbulence effect in different situations is found, nor is there a general theory including all observed effects at conditions of interest. Only in the case of a turbulent boundary layer at zero pressure gradient, a quantitative relation is known between the turbulence in the free stream and the boundary layer development. It is concluded, therefore, that new experimental work using advanced measuring techniques and a secured theoretical background is urgently needed for planning new wind tunnels for transonic testing at high Reynolds numbers. Author

N73-26285 City Univ., London (England). Dept. of Aeronautics.
DESIGN OF VENTILATED WALLS WITH SPECIAL EMPHASIS ON THE ASPECT OF NOISE GENERATION c11
R. N. Cox and M. M. Freestone *In* AGARD Fluid Motion Probl. in Wind Tunnel Design Apr. 1973 7 p refs (For availability see N73-26279 17-12)

The parameters influencing the design of ventilated wind tunnel walls in current use are reviewed, and noise generation by such walls is analyzed. By drawing an analogy between results from flows past two-dimensional cavities and the discrete frequency tones generated by perforated walls, some suggestions are made about the mechanisms responsible for the tones. Finally some possible methods of reducing unwanted noise from tunnel walls are discussed. Author

N73-26286*# Aerojet Liquid Rocket Co., Sacramento, Calif.
MULTIPLE JET STUDY Final Report
R. E. Walker and D. L. Kors Jun. 1973 111 p refs
(Contract NAS3-15703)
(NASA-CR-121217) Avail: NTIS HC $7.75 CSCL 20D

Test data is presented which allows determination of jet penetration and mixing of multiple cold air jets into a ducted subsonic heated mainstream flow. Jet-to-mainstream momentum flux ratios ranged from 6 to 60. Temperature profile data is presented at various duct locations up to 24 orifice diameters downstream of the plane of jet injection. Except for two configurations, all geometries investigated had a single row of constant diameter orifices located transverse to the main flow direction. Orifice size and spacing between orifices were varied. Both of these were found to have a significant effect on jet penetration and mixing. The best mixing of the hot and cold streams was achieved with duct height. Author

N73-26287# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
SIMILARITY CONSIDERATIONS IN FACILITATED TRANSPORT
David Yung and Ronald F. Probstein Apr. 1973 26 p refs
(Grant NSF GK-35798X)
(Pub-73-2) Avail: NTIS HC $3.50 CSCL 20D

Similarity parameters are presented for the facilitated transport of a gas through a liquid membrane in which the gas concentration on the downstream side of the membrane is negligible. The membrane facilitation performance is shown to depend on three similarity parameters: (1) a dimensionless initial gas concentration on the upstream face of the membrane; (2) a parameter which measures the diffusion rate of the liquid to the backward chemical reaction rate; and (3) one which measures the diffusion rate of the gas to the forward chemical reaction rate. The process is shown to be characterized theoretically by a single second order equation. Numerical solutions of this equation are presented. It is shown that the facilitation characteristics of the membrane are easily mapped out in terms of a dependent parameter which measures the degree of chemical disequilibrium of the system, and a parameter which is a ratio of the total to initial carrier concentration. Author

N73-26288*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDY OF THE FAR WAKE VORTEX FIELD GENERATED BY A RECTANGULAR AIRFOIL IN A WATER TANK
Dietrick K. Lezius May 1973 10 p refs
(NASA-TM-X-62274) Avail: NTIS HC $3.00 CSCL 20D

Underwater towing experiments were carried out with a rectangular airfoil of aspect ratio 5.3 at 4 and 8 deg angles of attack and at chord-based Reynolds numbers between 2 x 100,000 and 7.5 x 100,000. Quantitative measurements by means of the hydrogen bubble technique indicated lower peak swirl velocities in the range of 100 to 1000 lengths downstream than have been measured in wind tunnel of flight tests. The maximum circumferential velocity decayed whereas the turbulent eddy viscosity increased. This behavior and other known rates of vortex decay are explained in terms of an analytical solution for the vortex problem with time varying eddy viscosity. It is shown that this case corresponds to nonequilibrium turbulent vortex flow. Author

N73-26289*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
A NUMERICAL SOLUTION FOR THERMOACOUSTIC CONVECTION OF FLUIDS IN LOW GRAVITY
L. W. Spradley, S. V. Bourgeois, C. Fan, and P. G. Grodzka Washington NASA May 1973 90 p refs
(Contract NAS8-27015)
(NASA-CR-2269; LMSC/HREC-TR-D306140) Avail: NTIS HC $3.00 CSCL 20D

A finite difference numerical technique for solving the differential equations which describe thermal convection of compressible fluids in low gravity are reported. Results of one-dimensional calculations are presented, and comparisons are made to previous solutions. The primary result presented is a one-dimensional radial model of the Apollo 14 heat flow and convection demonstration flight experiment. The numerical calculations show that thermally induced convective motion in a confined fluid can have significant effects on heat transfer in a low gravity environment. Author

N73-26290# Lockheed Missiles and Space Co., Palo Alto, Calif.
NONSTATIONARY ONE-DIMENSIONAL VISCOUS FLUID

FLOW IN A DEFORMABLE TUBE
V. S. Gubenko, P. Kh. Derkach, and V. N. Kuznetsov [1973] 4 p refs Transl. into ENGLISH from Prikl Mekh. (USSR), v. 9, no. 4, 1973 p 104-107
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The nonstationary flow of an incompressible viscous fluid which moves within an elastic cylindrical tube is investigated. Displacements performed by the cylindrical surface particles because of its elastic deformations are determined by a vector. Author

N73-26291*# Kanner (Leo) Associates, Redwood City, Calif.
GROUND EFFECT VISUALIZATION AT LOW SPEED AROUND AIRCRAFT MODELS
Henri Werle Washington NASA Jun. 1973 27 p refs Transl. into ENGLISH from Rech. Aerospatiale (Paris), no. 2, Mar. - Apr. 1970 p 79-93
(Contract NASw-2481)
(NASA-TT-F-14958) Avail: NTIS HC $3.75 CSCL 20D

The analysis of the ground effect on the flow around models, using visualization obtained in a hydraulic test tunnel is discussed. The ground simulation methods previously developed for fundamental research have been used for aerodynamic studies applied to actual aircraft such as Airbus-type air intake, VTOL jet aircraft, and Concorde with or without simulation of a downward vertical movement. Author

N73-26292*# Scientific Translation Service, Santa Barbara, Calif.
THE INFLUENCE OF AN INCLINED JET ON THE FLOW FIELD IN THE VICINITY OF A LIFTING SURFACE AND ON ITS AERODYNAMIC COEFFICIENTS
M. Seidel Washington NASA Jul. 1973 67 p refs Transl. into ENGLISH from the German Report DFLR-68-20
(Contract NASw-2483)
(NASA-TT-F-14956; DFLR-68-20) Avail: NTIS HC $5.50 CSCL 20D

Systematic three-component measurements were carried out on a lifting surface model (profile NACA 0010 between end discs) in order to clarify the influence of interference of an engine jet on the aerodynamics of a lifting surface. Changes in the aerodynamic force coefficients, and in particular the lift, were determined which are induced by the horizontal or vertical jet. The most important parameters are the position of the jet nozzle with respect to the lifting surface leading edge and the velocity ratio of the jet and parallel flow. The experimental installation is described in detail. Preliminary experiments are discussed which determine the properties of the jet and its propagation in the parallel flow. In addition, results for the jet which is parallel and perpendicular to the lifting surface plane are reported. Author

N73-26293# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.
THE APPLICATION OF EQUIDENSITOMETRY FOR DIAGNOSIS OF A TWO-PHASE FLOW AND A FLOW OF LOW DENSITY [DIE ANWENDUNG DER AEQUIDENSITOMETRIE ZUR DIAGNOSE VON ZWEIPHASENSTROEMUNGEN UND STROEMUNGEN GERINGER DICHTE]
Gustav Schweiger, Kurt Wanders, and Herbert Wiegand 23 Jan. 1973 39 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-73-02) Avail: NTIS HC $4.00; DFVLR Porz-Wahn: 28,50 DM

Equidensitometry is dealt with as a photographic method of evaluation in flow measurement techniques. The basic principles of equidensitometry are presented and the production of photographic equidensities is described using a flow pattern photograph. The intermediate results of the method are depicted and the separate steps in the procedure are explained. The application of equidensitometry and its significance to flow measurement is exemplified for a two phase flow and a low density flow. ESRO

N73-26294# Pennsylvania State Univ., University Park. Ordnance Research Lab.
FLUCTUATING PRESSURE CHARACTERISTICS IN THE MIXING REGION OF A PERTURBED AND UNPERTURBED ROUND FREE JET M.S. Thesis
Galen L. Barefoot 4 Aug. 1972 106 p refs
(Contract N00017-70-C-1407)
(AD-759377; TM-72-165) Avail: NTIS CSCL 20/4

Theoretically, near-field pressure measurements in a turbulent flow can be used to predict far-field acoustic radiation. The basis of this study is the experimental verification of methods for obtaining the necessary data. Pressure intensity, spectra and cross-correlation data are obtained in three types of jet flows. The characteristic scale of pressure fluctuations is compared to the equivalent velocity scales. Consideration is given to errors associated with frequency response, low frequency cutoff and probe-turbulence interaction. Estimates of the various errors are given and certain correction procedures are suggested. Author (GRA)

N73-26295# Pennsylvania State Univ., University Park. Ordnance Research Lab.
THE INFLUENCE OF SURFACE IRREGULARITIES ON CAVITATION: A COLLATION AND ANALYSIS OF NEW AND EXISTING DATA WITH APPLICATION TO DESIGN PROBLEMS M.S. Thesis
J. C. Bohn 27 Sep. 1972 85 p refs
(Contract N00017-70-C-1407)
(AD-759030; TM-72-223) Avail: NTIS CSCL 20/4

The objective of this thesis is to correlate the available cavitation data on surface irregularities in an effort to predict the actual cavitation performance of surfaces encountered in the field. In so doing, the various field irregularities were modeled by the idealized roughness elements studied in the laboratory. A review of the available experimental results revealed a lack of data on isolated depressions, so tests were conducted in a water tunnel to determine the cavitation characteristics of isolated slots, thus providing the data necessary to model at least one type of depression occurring in the field. GRA

N73-26296# Naval Postgraduate School, Monterey, Calif.
APPLICATION OF HOLOGRAPHIC INTERFEROMETRY TO DENSITY FIELD DETERMINATION IN TRANSONIC CORNER FLOW M.S. Thesis
D. J. Collins and Robert A. Kosakoski Dec. 1972 125 p refs
(AD-759967; NPS-57C072121A) Avail: NTIS CSCL 20/4

The successful application of holographic interferometry to the study of density fields around opaque bodies in wind tunnel experiments has been reported in the literature. The present report extends this technique to the study of the asymmetric flow fields encountered near the wing-fuselage junction of an aerodynamic model in the transonic flow regime. Finite fringe interferometry has been used to investigate the three-dimensional density field about a partially transparent wing-body structure. The resulting asymmetric density field and shock wave structure are shown to be an accurate representation of the phenomena encountered in aerodynamic corner flow. Author (GRA)

N73-26297# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF INITIAL TURBULENCE ON THE FLOW AROUND BODIES AND ON THEIR AERODYNAMIC CHARACTERISTICS
S. M. Gorlin 27 Apr. 1973 21 p refs Transl. into ENGLISH from Nauc. Tr. Inst. Mekh. (USSR), no. 1, 1970 p 34-45
(AD-760264; FTD-HT-23-0212-73) Avail: NTIS CSCL 20/4

It has seemed advantageous to investigate the effect of turbulence intensity on the aerodynamics of bodies of different shapes, to define more accurately the methods of measuring the initial turbulence, as well as to seek effective means for measuring within wide limits the value of the turbulence intensity for a flow in the test section of a wind tunnel and means for keeping it at the needed level in the entire model area. GRA

N73-26298# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE SUPERSONIC TURBULENT BOUNDARY LAYER IN AN ADVERSE PRESSURE GRADIENT: EXPERIMENT AND DATA ANALYSIS
Walter B. Sturek Mar. 1973 47 p refs
(DA Proj. 1T0-61102-A-33D)
(AD-759915; BRL-1639) Avail: NTIS CSCL 20/4

Experimental measurements of the profile characteristics of the supersonic turbulent boundary layer in a region of moderate adverse pressure gradient and an analysis of the data are reported. The data are for a closely adiabatic wall at a tunnel nozzle setting of M = 3.54. All measurements necessary for a complete set of profile data were made. Turbulent boundary layer equations are analyzed by numerical integration using the tabulated profile data. The data correlated in law of the wall and velocity defect dimensionless coordinates using an integral compressibility transformation. Distributions of eddy viscosity and mixing length are calculated using the mean profile data.
Author (GRA)

N73-26299# Army Foreign Science and Technology Center, Charlottesville, Va.
NONSTATIONARY HEAT AND MASS EXCHANGE IN THE AREA OF THE FORWARD STAGNATION POINT
N. A. Pokryvailo 7 Mar. 1973 13 p refs Transl. into ENGLISH from the book "Nauka i Tekh." Minsk, 1968 p 185-194
(AD-760396; FSTC-HT-23-1493-72) Avail: NTIS CSCL 20/4

The study of nonsteady-state heat or mass transfer in the region of the forward stagnation point has great significance. As the results of experimental investigation of transverse flow around a cylinder show, the flow pattern in the rear zone -- namely in the neighborhood of the rear stagnation point over a certain range of Re -- is analogous to the flow in the region of the forward stagnation point. The author considers a round cylinder surrounded by a steady liquid flow field. Heat and mass transfer to the cylinder are described by equations. Two cases are of interest: (1) concentration (or temperature) at the surface of the cylinder varies according to some arbitrary function; (2) concentration (or temperature) change occurs discontinuously. GRA

N73-26300# Iowa Inst. of Hydraulic Research, Iowa City.
TURBULENT NONBUOYANT OR BUOYANT JETS DISCHARGED INTO FLOWING OR QUIESCENT FLUIDS
Tzeng-Long Chan and John F. Kennedy Aug. 1972 167 p refs
(Contract N00014-68-A-0196-0004)
(AD-760028; IIHR-140) Avail: NTIS CSCL 20/4

Two closely related problems are investigated: round turbulent nonbuoyant jets in cross-streams, and inclined turbulent buoyant jets in quiescent homogeneous fluids. Experiments were conducted for the first problem at a jet Reynolds number of 200,000. Pressure distributions on the jet-exit plane, and velocity distributions in the center plane were measured for values. Data on drag forces, jet centerlines, half-widths, and centerline velocities were obtained from the experiments. An integral-type analysis was carried out for the two problems investigated. The equations are solved in Cartesian coordinates for the near-field of both problems and for the far-field of the nonbuoyant jet, and in a natural coordinate system for the curvilinear zone of the nonbuoyant jet. (Author Modified Abstract) GRA

N73-26301# Picatinny Arsenal, Dover, N.J.
A METHOD FOR LOCATING SHOCK WAVES AND CONTOURS OF FLOW VARIABLES IN FINITE DIFFERENCE FLOW FIELDS
Eugene M. Friedman and Charles L. Wright Apr. 1973 50 p refs
(AD-759898; PA-TM-2079) Avail: NTIS CSCL 19/6

A computer program, CONSHOC, has been developed which, from the results of finite difference flow fields, produces contours of constant static pressure, density, fluid velocity relative to a fixed coordinate system, and local Mach numbers of the fluid relative to a moving coordinate system. Included is an option to locate the shock waves present in the flow field and superimpose them on the pressure plot. The major part of the input data is produced by slightly modified BLAST code computations. The method is general, however, and may be used on any finite difference flow field. Author (GRA)

N73-26302# Utah State Univ., Logan.
SOLVING THREE DIMENSIONAL POTENTIAL FLOW PROBLEMS BY MEANS OF AN INVERSE FORMULATION AND FINITE DIFFERENCES
Allen L. David and Roland W. Jeppson Mar. 1973 51 p refs
(Contract N00014-67-A-0220-0003; SR0090101)
(AD-760347; PRWG-96-2) Avail: NTIS CSCL 20/4

A finite difference method is developed to solve the three-dimensional, steady, incompressible, potential flow equations obtained by using a potential function, phi, and two mutually orthogonal stream functions, psi and psi*, to describe the flow. Problems are formulated in an inverse space where the potential function and the two stream functions are the independent variables, and the Cartesian coordinates x, y, and z are the dependent variables. The boundaries of the problem in the physical space, including the free surface, have known positions in the inverse space, so trial and error adjustments to the positions of the boundaries are unnecessary. Methods of describing the effect of the placement of a body, whose shape is partially specified, in the flow field are developed using finite differences, and a solution for the x-, y-, and z-coordinates is obtained at each grid point formed by the intersection of surfaces held constant with respect to phi, psi, and psi* in the inverse space.
Author (GRA)

N73-26303# Hydronautics, Inc., Laurel, Md.
A PARAMETRIC ANALYSIS OF FAST HYDROFOIL CONFIGURATIONS
Eugene Miller, Jr., Ronald Altmann, Gary Poquette, and Horton Lain Nov. 1972 168 p refs
(Contract N00600-72-D-0307)
(AD-760355; TR-7224-1) Avail: NTIS CSCL 13/10

A parametric design study was conducted to determine the characteristics and performance of a family of high speed hydrofoil craft in the size range from 100 to 300 tons gross weight and in the speed range from 60 to 90 knots. The results are presented in tables and plots of characteristics, speed and range as a function of size, design speed and sea state. Sensitivity studies were conducted to determine the importance and influence of the assumed and calculated parameters on the craft characteristics and performance. The product of two lift drag ratio and the propulsion coefficient was the most important parameter effecting the performance and the one which could be calculated with the least precision. (Modified Author Abstract) GRA

N73-26304# Rochester Applied Science Associates, Inc., N.Y.
INVESTIGATION OF THE EFFECTS OF MASS INJECTION TO RESTRUCTURE A TRAILING TIP VORTEX AT TRANSONIC SPEEDS Final Technical Report, 15 Feb. 1972 - 14 Feb. 1973
John C. Balcerak and Andrew D. Zalay Feb. 1973 87 p refs
(Contract N00014-71-C-0226; NR Proj. 215-170)
(AD-760363; RASA-73-03) Avail: NTIS CSCL 20/4

The report describes the results of an experimental research program which as conducted to assess the effects of mass injection of the tip vortex on airfoil performance in transonic flow. Balance data and schlieren photographs were taken for a rectangular semispan model with a full-span aspect ratio of 7.35 in the Mach number range M = 0.553 to 0.1. The results of the investigation indicate that mass injection of the concentrated tip vortex does not generate any significant change in airfoil performance at transonic speeds for the configurations tests. Schlieren photographs of the compressible flow field showed that the near field flow characteristics of the airfoil were not influenced by mass injection or by passive nozzle characteristics at transonic speeds. The schlieren photographs showed considerable alterations to the vortex wake by the local shock structure of the airfoil as the lambda shock appeared to disrupt the trailing vortex independently of mass injection. Author (GRA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-26305 Institute of Geological Sciences, London (England).
MAGNETIC RESULTS, 1970: ESKDALEMUIR, HARTLAND AND LERWICK OBSERVATORIES Geomagnetic Bulletin

No. 4
1973 163 p
(SGN-11-880601-7; Bull-4) Copyright. Avail: HMSO £4; PHI $15.50

Geomagnetic measurements of the atmosphere in Great Britain are presented in tabular form. These measurements were made with variometers and other absolute instruments during 1970. J.A.M.

N73-26306 Utah State Univ., Logan.
FORMATION THEORY OF SPORADIC E BY TIDAL WIND SYSTEMS Ph.D. Thesis
Roger Rong Taur 1972 119 p
Avail: Univ. Microfilms Order No. 73-920

Analysis of large samples of sporadic E data show that sporadic E is more likely to occur in the late afternoon than in the middle of the day, even though the background ionization of the E region is less in the afternoon. This situation produces E patches in the afternoon which are less intense than during midday but there are more of them. There is also a smaller occurrence peak in the summer morning. This asymmetric occurrence feature of Es must be attributed to the wind since the variation is different from the variation of the normal E region. Theoretical electron density profiles have been calculated with a daytime Chapman-like E region ionization and with tidal wind components extracted from the rocket data by Woodrum. The diurnal; semidiurnal and prevailing winds (90-135 km) are mated to the winds derived from meteor radar measurements (80-100 km) in order to get the seasonal variations of the tidal wind components. Dissert. Abstr.

N73-26307 California Univ., San Diego.
PARTICLE TRACK RECORDS IN NATURAL SOLIDS FROM OCEANS ON EARTH AND MOON Ph.D. Thesis
John Douglas MacDougall 1972 256 p
Avail: Univ. Microfilms Order No. 73-865

Several earth science problems which involve charged particle tracks are discussed. These include: the dating of rocks from the ocean floor; the dating of components of oceans sediments; and the investigation of kinetic processes in the lunar regolith. Methods are described for processing small amounts of material, for increasing contrast through use of dyes and metal plating of tracks, and for increasing resolution through use of an electron microscope replica technique. Attention is given to problems of fission track dating natural glasses: use of proper etching solutions, accurate neutron flux measurements, and absolute calibration of the dating method. Dissert. Abstr.

N73-26308 California Univ., Los Angeles.
THE LOW-LATITUDE ASYMMETRIC DISTURBANCE IN THE GEOMAGNETIC FIELD Ph.D. Thesis
Nancy Uss Crooker 1972 105 p
Avail: Univ. Microfilms Order No. 72-33909

Harmonic analysis of the low attitude disturbance field is performed on hourly and 2.5-minute magnetic data. The interrelationships between the resulting parametes and other storm indices are studied using histograms, scatter plots, and correlations. The histograms reveal local time, longitude, and universal time preferences of 18 h, 45 deg, and 15 h, respectively, for the asymmetric disturbance field. The amplitude G of the first harmonic is typically 50 gamma for large storms. The results of the data analysis are interpreted in terms of suggested current system models. Emphasis is given to a two-current-system model: a partial ring current centered near 18 h local time and a second system connected to the westward electrojet in the midnight sector. A numerical model of a partial ring current distributed along and across L-shells is developed in which measurements or models of the ring current particles can be used to determine the disturbance field and magnetization currents can be taken into account. These are advantages over previous line. Dissert. Abstr.

N73-26309 Drexel Univ., Philadelphia, Pa.
ATMOSPHERIC DIFFUSION OF RADON IN A TIME-HEIGHT REGIME Ph.D. Thesis
Wilson A. Shaffer 1973 116 p
Avail: Univ. Microfilms Order No. 73-95

Radon gas concentration, wind speed and direction, and temperature measurements from a 1000 ft tower were used to study the time and height dependence of atmospheric diffusion. Monthly averages of hourly radon measurements as well as temperature and wind speed show a distinct diurnal variation with height. Phase lags and amplitude variations predicted by solutions of the diffusion equation are shown to be in poor agreement with the values measured using radon. Dissert. Abstr.

N73-26310 California Univ., San Diego.
VAPOR CONDENSATION OF Ni-Fe PHASES AND RELATED PROBLEMS, 1. THE PALEOMAGNETIC RECORD IN CARBONACEOUS CHONDRITES, 2 Ph.D. Thesis
Aviva Brecher 1972 377 p
Avail: Univ. Microfilms Order No. 72-33078

Some properties of refractory magnetic meteoritic solids (Ni-Fe alloys and Fe3O1), likely to have preserved information on the mode of growth and its fossil environment, such as crystal phase-structure and morphology, magnetic and mechanical properties, gases occluded at growth, were studied experimentally. The major emphasis was placed on unraveling the paleomagnetic record in carbonaceous chondrites which represent a sample of the oldest and least altered fraction of solar system material. A sizeable (from 0.0001 to .1 emu/g) and stable paleoremanence was found in most of the 13 carbonaceous meteorites of all types investigated. By exploiting the memory-effect of magnetite, the stablest fraction of natural remanent magnetization (NRM) residing in singledomain Fe3O4 grains was recovered. The study of demagnetization behavior of the NRM and of the saturation remanence and values of magnetic parameters allowed magnetic type casting of carbonaceous chondrites Author

N73-26311 Pennsylvania State Univ., University Park.
ELECTRON PRODUCTION, RECOMBINATION, AND HEATING IN THE F-REGION OF THE IONOSPHERE Ph.D. Thesis
Wesley Elwood Swartz 1972 212 p
Avail: Univ. Microfilms Order No. 72-33210

Photoionization rates were calculated from recent solar EUV flux measurements and are compared with the electron-ion recombination rates estimated from electron density profiles and current reaction rates. These photoionization rates also provided the first step in calculating the photoelectron heating rates of the ambient electrons which are compared with the cooling rates deduced from ion and electron temperature measurements at Arecibo. The effects of changes in the assummed neutral models, in the rate coefficients, and in the temperature measurements were investigated. Dissert. Abstr.

N73-26312*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF ERTS AND EREP IMAGES TO GEOLOGIC INVESTIGATIONS OF THE BASIN AND RANGE. COLORADO PLATEAU BOUNDARY IN NORTHWESTERN AND NORTH-CENTRAL ARIZONA Progress Report, 15 Feb. - 15 Apr. 1973
A. F. H. Goetz, Principal Investigator, F. C. Billingsley, D. P. Elston (Geol. Surv., Flagstaff, Ariz.), I. Luccitta (Geol. Surv., Flagstaff, Ariz.), and E. M. Shoemaker (Calif. Inst. of Tech., Pasadena) 18 May 1973 4 p Sponsored by NASA ERTS (E73-10645; NASA-CR-132235) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-26313*# Kansas Univ. Center for Research, Inc., Lawrence.
DETECTION OF WATER BODIES IN SALINE COUNTY, KANSAS
B. G. Barr, Principal Investigator 10 May 1973 4 p ERTS (Grant NGL-17-004-024)
(E73-10684; NASA-CR-132191) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. A total of 2,272 water bodies were mapped in Saline County, Kansas in 1972 using ERTS-1 imagery. A topographic map of 1955 shows 1,056 water bodies in the county. The major increase took place in farm ponds. Preliminary comparison of image and

maps indicates that water bodies larger than ten acres in area proved consistently detectable. Most water areas between four and ten acres are also detectable, although occasionally image context prevents detection. Water areas less than four acres in extent are sometimes detected, but the number varies greatly depending on image context and the individual interpretor.

N73-26314*# Alabama Univ., University.
AN INVESTIGATION TO DETERMINE THE OPTIMUM MONITORING SITES FOR PLACING ERTS DATA COLLECTION PLATFORMS IN A RIVER BASIN M.S. Thesis
Harold R. Henry, Principal Investigator and Charles Lamar Larrimore 1973 112 p refs ERTS
(Contract NAS5-21876)
(E73-10689; NASA-CR-132200) Avail: NTIS HC $7.75 CSCL 08H

There are no author-identified significant results in this report.

N73-26315*# Texas A&M Univ., College Station. Remote Sensing Center.
MONITORING THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION Progress Report, Sep. 1972 - Mar. 1973
John W. Rouse, Jr., Principal Investigator, R. H. Haas, J. A. Schell, and D. W. Deering Apr. 1973 120 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21857)
(E73-10693; NASA-CR-132982) Avail: NTIS HC $8.00 CSCL 08F

There are no author-identified significant results in this report.

N73-26316*# Michigan State Univ., East Lansing.
USE OF ERTS DATA FOR A MULTIDISCIPLINARY ANALYSIS OF MICHIGAN RESOURCES Progress Report
Axel L. Anderson, Principal Investigator 28 Jun. 1973 14 p
(Contract NAS5-21834)
(E73-10703; NASA-CR-133016; PR-4) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. A computerized procedure has been developed to correlate coordinates from topographic maps and/or aerial photographs with ERTS data coordinates. Application to data from other multispectral scanners is anticipated. In the procedure, a map transformation from earth coordinates to ERTS point and line numbers is calculated using selected ground control points and the method of least squares. The map transformation is then applied to the earth coordinates of selected areas to obtain the corresponding ERTS point and line numbers. An optional provision allows moving the boundaries of the plots inwards by variable distances (typically half a resolution element) so the selected pixels will not overlap adjacent features.

N73-26317*# Geological Survey, Denver, Colo.
A STUDY OF MORPHOLOGY, PROVENANCE, AND MOVEMENT OF DESERT SAND SEAS IN AFRICA, ASIA, AND AUSTRALIA Progress Report, 1 May - 30 Jun. 1973
Edwin D. McKee, Carol S. Breed (Geol. Surv., Flagstaff, Ariz.), and Lawrence F. Harris, Principal Investigators (Geol. Surv., Flagstaff, Ariz.) 1 Jul. 1973 5 p ERTS
(NASA Order S-70243-AG-4)
(E73-10710; NASA-CR-133061) Avail: NTIS HC $3.00 CSCL 08M

The author has identified the following significant results. Examination of sand samples from both dune and interdune areas at White Sands, New Mexico, indicates marked differences in composition and texture between these two types of facies. If these differences are characteristics of dune fields in general, information concerning them may help to explain the contrast in appearance of the two kinds of sand areas on ERTS imagery and to permit interpretation of similar features in remote areas, such as Saudi Arabia.

N73-26318*# National Center for Earthquake Research, Menlo Park, Calif.
INVESTIGATION OF PROTOTYPE VOLCANO-SURVEILLANCE NETWORK Progress Report, 1 May - 30 Jun. 1973
Jerry P. Eaton, Principal Investigator and Peter L. Ward 1 Jul. 1973 9 p refs ERTS
(NASA Order S-70243-AG-2)
(E73-10711; NASA-CR-133062) Avail: NTIS HC $3.00 CSCL 08K

The author has identified the following significant results. The equipment installed in the volcano surveillance network continues to work quite reliably and earthquakes are being recorded at all sites. A summary of platform receptions per day has been prepared.

N73-26319*# Bureau of Land Management, Riverside, Calif.
PREDICT EPHEMERAL AND PERENNIAL RANGE QUANTITY AND QUALITY DURING NORMAL GRAZING SEASON Progress Report, 1 May - 30 Jun. 1973
Gordon Bentley, Principal Investigator 1 Jul. 1973 3 p ERTS
(NASA Order S-70243-AG-1)
(E73-10712; NASA-CR-133063) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-26320*# Geological Survey, Washington, D.C.
SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND Progress Report, 1 May - 30 Jun. 1973
Richard S. Williams, Jr., Principal Investigator 1 Jul. 1973 8 p ref Sponsored by NASA ERTS
(E73-10713; NASA-CR-133064) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. A low sun angle (as low as 7 degrees) on ERTS-1 imagery, particularly when the terrain is snow-covered, markedly enhances subtle geologic structure and landforms. Hot springs, discharging into frozen lakes, from an ice-free area which can be easily seen on ERTS-1 imagery. In remote areas ERTS-1 imagery can be used in climatological studies by using the time of lake ice freeze-up and break-up as a measure over large areas. ERTS-1 imagery of the erupting volcano, Kirkjufell, on the island of Heimaey was cloud covered. ERTS-1 provides a powerful new tool for volcanologists to study erupting volcanoes, new deposits of lava, and the direction and areal distribution of the eruption plume. Some success was achieved in a preliminary study, using photogrammetric instrumentation, of measuring relative elevation of mountains using ERTS-1 imagery of iceland, where considerable overlap exists in successive orbits.

N73-26321*# Bureau of Sport Fisheries and Wildlife, Jamestown, N.D. Northern Prairie Wildlife Research Center.
APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Progress Report, 1 Jan. - 30 Jun. 1973
Harvey K. Nelson, Principal Investigator and Edgar A. Work 1 Jul. 1973 12 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG-4)
(E73-10714; NASA-CR-133065) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-26322*# Iowa State Univ. of Science and Technology, Ames.
REMOTE SENSING IN IOWA AGRICULTURE Progress Report, period ending 30 Apr. 1973
John P. Mahlstede, Principal Investigator and Richard E. Carlson 4 May 1973 4 p ERTS
(Contract NAS5-21839)
(E73-10715; NASA-CR-133215) Avail: NTIS HC $3.00 CSCL 02C

The author has identified the following significant results. Photo-interpretive methods have been used for vegetation identification to include additive false color analysis using the I2S Miniadcol system. Enlarged black and white ERTS-1 imagery

provides excellent synoptic coverage over large areas and this provides the vegetation type interpreter with a first tool. Analysis of field type using MSS bands individually gives the interpreter only shades of gray to base his decision. Combining the MSS bands and adding color through the I2S Miniadcol system provides the interpreter a greater degree of freedom in his decision making process. The information potentially available from ERTS-1 can be of great use in state planning and as an aid to the present crop survey programs.

N73-26323*# Maryland Dept. of State Planning, Baltimore.
INVESTIGATION OF APPLICATION OF ERTS-A DATA TO INTEGRATED STATE PLANNING Interim Report, Oct. 1972 - Mar. 1973
Edwin Thomas, David S. Simonett, Principal Investigators, John Antenucci, John Garber, William G. Brooner, Wayne G. Rohde, and Dennis Woodward Apr. 1973 49 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21779)
(E73-10716; NASA-CR-133216) Avail: NTIS HC $4.50 CSCL 08B

There are no author-identified significant results in this report.

N73-26324*# TRW Systems Group, Redondo Beach, Calif.
ERTS IMAGE DATA COMPRESSION TECHNIQUE EVALUATION Monthly Progress Report, period ending 1 May 1973
Donald J. Spencer, Principal Investigator 7 May 1973 2 p ERTS
(Contract NAS5-21746)
(E73-10717; NASA-CR-133217; TRW-7132.1-15) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-26325*# International Imaging Systems, Mountain View, Calif.
OCEAN WATER COLOR ASSESSMENT FROM ERTS-1 RBV AND MSS IMAGERY Progress Report, Dec. 1972 - Apr. 1973
D. S. Ross, Principal Investigator 7 May 1973 11 p refs ERTS
(Contract NAS5-21862)
(E73-10718; NASA-CR-133218) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N73-26326*# Agricultural Research Service, Big Spring, Tex.
WIND EROSION OF SOILS Progress Report, 29 Jul. 1972 - 17 Mar. 1973
Donald W. Fryrear, Principal Investigator 7 May 1973 3 p ERTS
(NASA Order S-70251-AG)
(E73-10719; NASA-CR-133219) Avail: NTIS HC $3.00 CSCL 08M

There are no author-identified significant results in this report.

N73-26327*# National Marine Fisheries Service, Bay Saint Louis, Miss.
REMOTE SENSING DATA MANAGEMENT FROM A USER'S VIEWPOINT
William H. Stevenson, Principal Investigator and Thomas A. Vanselous May 1973 12 p ERTS
(NASA Order S-70246-AG)
(E73-10720; NASA-CR-133220) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. An experimental data bank in conjunction with the National Marine Fisheries Service's Fisheries Engineering Laboratory's (FEL) participation in the ERTS-1 program was established. The data management system was demonstrated to be effective in the performance of the NMFS-FEL ERTS-1 experiment involving several input sources and varying user requirements. The system is to be further evaluated under similar conditions during FEL participation in the Skylab and ERTS-B experiments.

N73-26328*# Arizona Univ., Tucson.
EVALUATION OF ERTS-1 IMAGE SENSOR SPATIAL RESOLUTION IN PHOTOGRAPHIC FORM Progress Report
P. N. Slater, Principal Investigator, R. L. Antos, and R. A. Showengerdt Jul. 1973 13 p ERTS
(Contract NAS5-21849)
(E73-10721; NASA-CR-133221; PR-5) Avail: NTIS HC $3.00 CSCL 14E

There are no author-identified significant results in this report.

N73-26329*# Iowa Univ., Iowa City.
UTILIZING ERTS-A IMAGERY FOR TECTONIC ANALYSIS THROUGH STUDY OF BIG HORN MOUNTAINS REGION Progress Report, 16 May - 15 Jul. 1973
Richard A. Hoppin, Principal Investigator 15 Jul. 1973 2 p ERTS
(Contract NAS5-21852)
(E73-10722; NASA-CR-133066) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Winter imagery in December 6-10, 1972 and January 11-13, 1972, provides optimum snow cover and depth such that, along with low sun angle, topography and drainage are markedly enhanced. Several features are visible that are poorly, or even not distinguishable on clear scenes without snow. Examples are Bear Butte (igneous plug) and Elkhorn Peak (dome) on scene (1136-17130), northeastern Black Hills, (1172-17130) a linear linking the Cascade anticline and Cretaceous hogbacks near Hot Springs, S. D. south to the Niobrara River, and (1140-17373) the Lake Basin fault zone north of Billings, Montana. Extremely heavy snows in April completely blot out all vegetation and topography in the Bighorn, Wind River, and Beartooth ranges.

N73-26330*# Dartmouth Coll., Hanover, N.H. Dept. of Geography.
LAND USE IN NORTHERN MEGALOPOLIS Progress Report
Robert B. Simpson, Principal Investigator 12 Jul. 1973 1 p ERTS
(Contract NAS5-21749)
(E73-10723; NASA-CR-133067; PR-7) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-26331*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Report, 7-31 May 1973
I. J. Sattinger, Principal Investigator 11 Jun. 1973 2 p EREP
(Contract NAS9-13283)
(E73-10724; NASA-CR-133068; MR-1) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified results in this report.

N73-26332*# International Imaging Systems, Mountain View, Calif.
OCEAN WATER COLOR ASSESSMENT FROM ERTS-1 RBV AND MSS IMAGERY Progress Report, 8 May - 7 Jul. 1973
D. S. Ross, Principal Investigator 7 Jul. 1973 24 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21862)
(E73-10726; NASA-CR-133070) Avail: NTIS HC $3.25 CSCL 08J

The author has identified the following significant results. Photo-optical and electronic density slicing were applied to ERTS-1 E 1007-151651-4, 30 July 1972, an area in the Caribbean showing deep ocean water, and shallow areas on the Great Baham Bank ranging from 0.5 meter or less to 18 meters. The

density slicing processes were adjusted to correlate water radiance to bathmetric contours shown on C and GS Chart 1112. A number of large areas corresponding to water depths of 2 meters or less, 5 to 10 meters, and 10 to about 20 meters were isolated by both processes. Where clear water and uniformly reflective bottom was found, clear of marine growths, the photo-optical and electronic image density slicing processes proved effective in delineating areas where the depth was in the order of 5 meters, plus or minus 1 meter.

N73-26333*# Corps of Engineers, San Francisco, Calif.
CALIFORNIA COAST NEARSHORE PROCESSES STUDY Progress Report, 1 May - 30 Jun. 1973
Douglas M. Pirie and David D. Stellar, Principal Investigators (Rockwell Intern. Corp., Downey, Calif.) Jul. 1973 9 p ERTS (NASA Order S-70257-AG)
(E73-10727; NASA-CR-133071; ERTS-1-1-4; PR-4) Avail: NTIS HC $3.00 CSCL 08C

The author has identified the following significant results. During the period 1 May to 30 June 1973 material was processed and interpreted for use in analyzing the three ocean seasons along the California coast. ERTS imagery from the first season of the year, called the Davidson Current period, was mosaiced and analyzed. The second season of the year, the Upwelling period, was mosaiced and interpretation was initiated. Imagery for the third ocean season, the Oceanic period, is being collected for future study.

N73-26334*# Oregon State Univ., Corvallis.
INVENTORY AND MONITORING OF NATURAL VEGETATION AND RELATED RESOURCES IN AN ARID ENVIRONMENT BY THE USE OF ERTS-1 IMAGERY Progress Report, 1 May - 30 Jun. 1973
Barry J. Schrumpf, Principal Investigator 30 Jun. 1973 6 p ERTS
(Contract NAS5-21831)
(E73-10728; NASA-CR-133072; PR-4) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. An evaluation of information content of ERTS-1 reconstituted photography in comparison with Apollo 6 and Gemini 4 photography has been accomplished for some landforms through the use of an image groupability testing procedure. Analysis of terrain feature-vegetation relationships has been completed. Ground truth data collected in the southern Arizona test site have indicated that many of the plants can be categorized as either evergreen, cool season deciduous, or warm season deciduous. Results from image groupability testing have been utilized to stratify an Apollo 6 scene and an ERTS-1 scene of the same area.

N73-26335*# Stanford Research Inst., Calif.
STUDY OF TIME LAPSE PROCESSING FOR DYNAMIC HYDROLOGIC CONDITIONS Progress Report, 7 May - 6 Jul. 1973
Sidney M. Serebreny, Principal Investigator 6 Jul. 1973 7 p ERTS
(Contract NAS5-21841)
(E73-10729; NASA-CR-133073) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-26336*# TRW Systems Group, Redondo Beach, Calif.
ERTS IMAGE DATA COMPRESSION TECHNIQUE EVALUATION Monthly Progress Report, period ending 1 Jul. 1973
Donald J. Spencer, Principal Investigator 9 Jul. 1973 2 p ERTS
(Contract NAS5-21746)
(E73-10730; NASA-CR-133074; TRW-7132.1-25) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. Tapes of compressed ERTS data were obtained to permit later reconstruction and to prove that in general four ERTS MSS tapes can be put onto a single compressed tape. A compressed tape was reconstructed and imagery made. The data were compressed using the essentially information preserving SSDIAM algorithm, with mappings of from 1 to 3 levels and imagery was made of the result. This imagery shows that no visual degradation results from the one level mapping while compression is significantly increased. Mappings of up to three levels shows negligible deterioration in areas of moderate to high data activity, but contouring is noticeable in areas of uniform data such as the plains region.

N73-26337*# Wolf Research and Development Corp., Pocomoke City, Md.
APPLICABILITY OF SATELLITE REMOTE SENSING FOR MONITORING SURFACE MINING ACTIVITIES Quarterly Progress Report, 8 Mar. - 8 Jun. 1973
R. L. Brooks and J. D. Pennewell 8 Jun. 1973 7 p
(Contract NAS9-13310)
(E73-10731; NASA-CR-133075; QPR-1) Avail: NTIS HC $3.00 CSCL 08I

There are no author-identified significant results in this report.

N73-26338*# Maryland Dept. of State Planning, Baltimore.
INVESTIGATION OF APPLICATION OF ERTS-A DATA TO INTEGRATED STATE PLANNING IN MARYLAND Progress Report, period ending 31 May 1973
Edwin L. Thomas, Principal Investigator 31 May 1973 9 p ERTS
(Contract NAS5-21779)
(E73-10732; NASA-CR-133076; PR-4) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-26339*# Zurich Univ. (Switzerland). Dept. of Geography.
SNOW SURVEY AND VEGETATION GROWTH IN HIGH MOUNTAINS (SWISS ALPS) Progress Report
Harold Haefner, Principal Investigator [1973] 9 p refs Sponsored by NASA ERTS
(E73-10733; NASA-CR-133077) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N73-26340*# Department of Agriculture, Washington, D.C.
CROP IDENTIFICATION AND ACREAGE MEASUREMENT UTILIZING ERTS IMAGERY Progress Report, 20 Dec. 1972 - 19 Jun. 1973
Donald H. VonSteen, Principal Investigator 19 Jun. 1973 11 p ERTS
(NASA Order S-70251-AG-3)
(E73-10734; NASA-CR-133078) Avail: NTIS HC $3.00 CSCL 02C

There are no author-identified significant results in this report.

N73-26341*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
AN INTERDISCIPLINARY STUDY OF THE ESTUARINE AND COASTAL OCEANOGRAPHY OF BLOCK ISLAND SOUND AND ADJACENT NEW YORK COASTAL WATERS Progress Report, 15 Dec. 1972 - 15 Feb. 1973
Edward Yost, Principal Investigator 15 Feb. 1973 2 p ERTS
(Contract NAS5-21792)
(E73-10735; NASA-CR-133079; ERTS-070) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N73-26342*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
AN INTERDISCIPLINARY STUDY OF THE ESTUARINE AND COASTAL OCEANOGRAPHY OF BLOCK ISLAND SOUND AND ADJACENT NEW YORK COASTAL WATERS Progress Report, 15 Feb. - 15 Apr. 1973
Edward Yost, Principal Investigator 15 Apr. 1973 2 p ERTS
(Contract NAS5-21792)
(E73-10736; NASA-CR-133080; ERTS-070) Avail: NTIS HC $3.00 CSCL 08C

There are no author-identified significant results in this report.

N73-26343*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
IN SITU SPECTRORADIOMETRIC QUANTIFICATION OF ERTS DATA Progress Report, 15 Dec. 1972 - 15 Feb. 1973
Edward Yost, Principal Investigator 15 Feb. 1973 2 p ERTS (Contract NAS5-21793)
(E73-10737; NASA-CR-133081; ERTS-069) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. A multispectral photo analysis of the Willcox Playa was also made using ERTS imagery on three consecutive overpasses. The results of the analysis showed that a time sequential multispectral color presentation relates color to environmental changes as a function of time, rather than spectral changes for any single date. Since the primary mission of ERTS is to detect changes in the environment, it is believed that this mode of data reduction would be employed further in conjunction with the conventional techniques.

N73-26344*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
IN SITU SPECTRORADIOMETRIC QUANTIFICATION OF ERTS DATA Progress Report, 15 Feb. 1973 - 15 Apr. 1973
Edward Yost, Principal Investigator 15 Apr. 1973 2 p ERTS (Contract NAS5-21793)
(E73-10738; NASA-CR-133082; ERTS-069) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-26345*# Experimental Cartography Unit, London (England).
CARTOGRAPHIC EVALUATION OF ERTS-1 IMAGERY FOR PART OF THE UNITED KINGDOM Semiannual Report, Dec. 1972 - May 1973
D. P. Bickmore, Principal Investigator and W. P. Smith (Fairey Surv. Ltd.) Jun. 1973 20 p refs Sponsored by NASA and Dept. of Trade and Ind., London ERTS
(E73-10739; NASA-CR-133083) Avail: NTIS HC $3.00 CSCL 08B

The author has identified the following significant results. The area around Bristol, England contained a variety of both natural and man-made features visible on ERTS imagery, notably the Seven Estuary, the Jurassic limestones of the Cotswold scarp, and a variety of major and minor communications routes and urban developments. Visual interpretive studies were carried out on the diapositive imagery in order to ascertain the extent to which various terrain features, broadly classified into Solid and Drift Geology, Topography, and Land use, were depicted on the four independent imagery bands. Quantitative assessment of the accuracy of map content suggests that the imagery is inadequate for most mapping purposes within the area of study, at least using traditional interpretation methods.

N73-26346*# Earth Satellite Corp., Washington, D.C.
FACILITATING THE EXPLOITATION OF ERTS IMAGERY USING SNOW ENHANCEMENT TECHNIQUES Bimonthly Progress Report, 1 May - 30 Jun. 1973
Frank J. Wobber, Principal Investigator, Kenneth Martin, and Roger Amato 6 Jul. 1973 14 p ERTS
(Contract NAS5-21744)
(E73-10741; NASA-CR 133085) Avail: NTIS HC $3.00 CSCL 08L

The author has identified the following significant results. Detection and analysis of fracture systems can be more effectively conducted utilizing snow cover as an enhancement tool. From analysis within the Great Barrington Test Site it appears that the use of aeromagnetic data effectively supplements lineament data acquired using ERTS imagery. Coincidence of lineaments derived from aeromagnetics with lineaments interpreted from ERTS imagery apparently indicate the presence of mineralized fracture systems and dikes. Utilizing both tools can increase the speed and efficiency of mineral exploration and geological mapping in areas where bedrock is obscured by a thick unconsolidated sediment cover.

N73-26347*# Vermont Univ., Burlington. Remote Sensing Lab.
POLLUTION MONITORING IN LAKE CHAMPLAIN USING ERTS-1 IMAGERY
A. O. Lind, Principal Investigator and E. B. Henson Jun. 1973 8 p Orgininal contains imagery. Original photography may be purchased from EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21753)
(E73-10742; NASA-CR-133086) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Band 4 imagery of April 7 and 25 show contrasting pollution effects due to seasonal and discharge variations. The pollution plume emanating from the International Paper Co. mill just north of Fort Ticonderoga was first detected on October 10 ERTS-1 imagery and now has been documented during spring high lake level conditions. The plume was observed extending further to the north and east than under low water conditions of October 10. This northward extension reflects a stronger northward current flow expected in the turbid southern leg of Lake Champlain. The extensive plume of April 25 represents full plant operation while the April 5 scene shows some plume traces directly over the submerged diffuser, discharge pipe representing minimal discharge during weekend plant operation. The ERTS-1 documentation will be used in developing a model of plume behavior under varying environmental conditions and will hopefully serve to assist in a major resource decision pending at U.S. Supreme Court level.

N73-26348*# Earth Satellite Corp., Berkeley, Calif.
INVESTIGATION TO DEVELOP A MULTISTAGE FOREST SAMPLING INVENTORY SYSTEM USING ERTS-1 IMAGERY Progress Report, May - Jun. 1973
Philip G. Langley, Principal Investigator and Jan W. VanRoessel May 1973 4 p ERTS
(Contract NAS5-21853)
(E73-10743; NASA-CR-133087) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N73-26349*# Maine Dept. of Transportation, Augusta.
TO MAP THE DISTRIBUTION OF GLACIOFLUVIAL DEPOSITS AND ASSOCIATED GLACIAL LANDFORMS Progress Report, 1 May 1973
Raymond G. Woodman, Principal Investigator 1 May 1973 2 p ERTS
(Contract NAS5-21747)
(E73-10745; NASA-CR-133113; PR-6) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N73-26350*# National Research Council, Bangkok (Thailand).
THAILAND NATIONAL PROGRAMME OF THE EARTH RESOURCES TECHNOLOGY SATELLITE Progress Report, Nov. 1972 - Jan. 1973
Pradisth Cheosakul, Principal Investigator Apr. 1973 28 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E73-10746; NASA-CR-133114) Avail: NTIS HC $3.50 CSCL 08F

The author has identified the following significant results. ERTS-1 data has been used to delineate floating rice regions with a clear distinction between irrigated and nonirrigated areas and recognition of orchard and horticultural crops. Alluvial fans marking the ancient river outlets in the northwestern portion of the Central Plain of Thailand and the shape and size of the flood plains in the central region have been identified and outlined. A new forestry map was constructed using band 5 and band 7 imagery combined with ground observations. A geologic map of Thailand has been constructed from ERTS imagery.

N73-26351*# National Environmental Satellite Services, Hillcrest Heights, Md. Environmental Sciences Group.
ERTS-1 ANOMALOUS DARK PATCHES

Alan E. Strong, Principal Investigator 13 Jul. 1973 2 p ERTS
(NASA Order S-70246-AG)
(E73-10747; NASA-CR-133115) Avail: NTIS HC $3.00 CSCL 14E

The author has identified the following significant results. Through combined use of imagery from ERTS-1 and NOAA-2 satellites it was found that when the sun elevation exceeds 55 degrees, the ERTS-1 imagery is subject to considerable contamination by sunlight even though the actual specular point is nearly 300 nautical miles from nadir. Based on sea surface wave slope information, a wind speed of 10 knots will theoretically provide approximately 0.5 percent incident solar reflectance under observed ERTS multispectral scanner detectors. This reflectance nearly doubles under the influence of a 20 knot wind. The most pronounced effect occurs in areas of calm water where anomalous dark patches are observed. Calm water at distances from the specular point found in ERTS scenes will reflect no solar energy to the multispectral scanner, making these regions stand out as dark areas in all bands in an ocean scene otherwise comprosed by a general diffuse sunlight from rougher ocean surfaces. Anomalous dark patches in the outer parts of the glitter zones may explain the unusual appearance of some scenes.

N73-26352*# Environmental Research Inst. of Michigan, Ann Arbor.
[SL-3 DATA REQUIREMENTS]
Lester V. Manderscheid, Principal Investigator 3 Jul. 1973 1 p EREP
(Contract NAS9-13332)
(E73-10748; NASA-CR-133116) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-26353*# National Environmental Satellite Service, Washington, D.C.
EVALUATION OF ERTS DATA FOR CERTAIN HYDROLOGICAL USES Phase 1 Report, Apr. - May 1973
Donald R. Wiesnet, Principal Investigator and David F. McGinnis May 1973 7 p
(NASA Order S-70246-AG)
(E73-10750; NASA-CR-133118) Avail: NTIS HC $3.00 CSCL 08H

The author has identified the following significant results. Melting ice has been detected in Lake Erie by comparison of visible and near infrared differential reflectance. This melting condition is confirmed by meteorological ground truth data and concurrent NOAA-2 thermal infrared data. Using near-synchronous ERTS-1 data, it was possible to determine the approximate ground resolution of NOAA-2 very high resolution radiometer by comparing the smallest identifiable ice crack in the imagery and measuring the same crack on the ERTS-1 image. It was determined that photointerpretation and analysis of a single Lake Erie image can, under certain conditions, provide meaningful data on ice dynamics. ERTS-1 imagery is effective for icepack monitoring of the Great Lakes, but the sampling interval of 18 days imposes a severe limitation. Maps of the snow cover in the American River basin for 16 March 1973 have been prepared using all four bands.

N73-26354*# National Marine Fisheries Service, Bay Saint Louis, Miss.
INVESTIGATION USING DATA FROM ERTS TO DEVELOP AND IMPLEMENT UTILIZATION OF LIVING MARINE RESOURCES Progress Report, 10 Mar. - 10 May 1973
William H. Stevenson, Principal Investigator 11 Jun. 1973 4 p ERTS
(NASA Order S-70246-AG)
(E73-10751; NASA-CR-133119; PR-4) Avail: NTIS HC $3.00 CSCL 08A

There are no author-identified significant results in this report.

N73-26355*# Kansas Univ., Lawrence. Space Technology Center.
[SKYLAB SITES IN KANSAS AND TEXAS] Monthly Progress Report
Joe R. Eagleman, Principal Investigator 18 Jun. 1973 1 p EREP
(Contract NAS9-13273)
(E73-10752; NASA-CR-133120) Avail: NTIS HC $3.00 CSCL 14B

There are no author-identified significant results in this report.

N73-26356*# Geological Survey Dept., Lobatse (Botswana).
TO ASSESS THE VALUE OF SATELLITE PHOTOGRAPHS IN RESOURCE EVALUATION ON A NATIONAL SCALE Progress Report, Jan. - May 1973
J. V. Hepworth, Principal Investigator and S. M. Akehurst May 1973 20 p refs Sponsored by NASA ERTS
(E73-10753; NASA-CR-133121) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. Small scale ERTS-1 imagery has enabled investigators to study large areas at a time. The imagery appears to confirm a new theory that Archean greenstone belts in NE Botswanna and SW Rhodesia are co-extensive and that these so-called schist relics formerly covered a much wider area than is apparent now. The central parts of the region bounded by the schist relics are believed to have suffered granitization. A remnant of an older drainage system to the southwest of the Okavango Swamps, which seems to have been newly discovered on the imagery, may be an indication of the seismic instability of the region. Even quite small earth movements in the swamps could radically affect the direction of water flow. The imagery has proved successful in showing areas infested by the water weed Salvinia Auriculata in the Chobe and Zambesi rivers. This will be immensely valuable in later surveys on the ground. If the satellite was to have continued working, the imagery would have enabled workers to determine the extent of encroachment of the weed without recourse to field observations.

N73-26357*# North Carolina State Univ., Raleigh. School of Physical and Mathematical Sciences.
UTILIZATION OF EREP DATA IN GEOLOGICAL EVALUATION, REGIONAL PLANNING, FOREST MANAGEMENT, AND WATER MANAGEMENT IN NORTH CAROLINA Quarterly Progress Report
Charles W. Welby, Principal Investigator 25 Jun. 1973 1 p EREP
(Contract NAS9-13321)
(E73-10754; NASA-CR-133122) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-26358*# Environmental Research and Technology, Inc., Lexington, Mass.
EVALUATE THE APPLICATION OF IMPROVED SPACECRAFT MEASUREMENTS FOR SNOW COVER SURVEY USING SKYLAB/EREP DATA Quarterly Progress Report, 14 Mar. - 14 Jun. 1973
Timothy T. White, Principal Investigator 20 Jun. 1973 3 p EREP
(Contract NAS9-13305)
(E73-10755; NASA-CR-133123; ERT-P-412-3; QPR-1) Avail: NTIS HC $3.00 CSCL 08L

There are no author-identified significant results in this report.

N73-26359*# Environmental Research Inst. of Michigan, Ann Arbor.
[SL-2 PLANS]
Lester V. Manderscheid, Principal Investigator 8 Jun. 1973 1 p EREP
(Contract NAS9-13332)
(E73-10759; NASA-CR-133127) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-26360*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
[SKYLAB PRELAUNCH PLANS] Monthly Report, Apr.

1973
LeRoy F. Silva, Principal Investigator 21 Jun. 1973 2 p EREP
(Contract NAS9-13301)
(E73-10760; NASA-CR-133128) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-26361*# Agricultural Research Service, Weslaco, Tex.
SOIL SALINITY DETECTION
Craig L. Wiegand, Principal Investigator 2 Jul. 1973 2 p EREP
(NASA Order T-4105-B)
(E73-10761; NASA-CR-133129) Avail: NTIS HC $3.00 CSCL 08M

There are no author-identified significant results in this report.

N73-26362*# Kennecott Exploration, Inc., Salt Lake City, Utah. Exploration Services Dept.
RECOGNITION OF THE GEOLOGIC FRAMEWORK OF PORPHYRY DEPOSITS ON ERTS-1 IMAGERY Progress Report, Jan. - Jun. 1973
John C. Wilson, Principal Investigator 12 Jul. 1973 7 p ERTS
(Contract NAS5-21769)
(E73-10762; NASA-CR-132204) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Photointerpretation methods have been most successfully applied in the less vegetated test sites where several previously unknown geologic features have been recognized and known ones extended. Northwest mid-Tertiary faults in the Ely, Nevada area are observed to offset north-trending ranges and abruptly terminate older Mesozoic structures. In the Ray, Arizona area the observed patterns of fault and fracture systems appear to be related to the locations of known porphyry copper deposits. In the Tanacross, Alaska area a number of regional circular features observed may represent near surface intrusions and, therefore, permissive environments for copper porphyries.

N73-26363*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATION OF THE IONOSPHERE AND METEORS
I. B. Biybosunov, ed. Washington NASA Jun. 1973 92 p refs Transl. into ENGLISH of the book "Issledovaniye Ionosfery i Meteorov" Frunze, Ilim Press, 1971
(Contract NASw-2038)
(NASA-TT-F-744) Avail: NTIS HC $3.00 CSCL 04A

Data collected during the International Year of the Quiet Sun program are summarized. Basic data are presented on ionospheric wind conditions in the meteor zone and equipment for radar observation of meteor trail drift. For individual titles, see N73-26364 through N73-26374.

N73-26364* Translation Consultants, Ltd., Arlington, Va.
CIRCULATION OF AIR MASSES IN THE UPPER ATMOSPHERE DURING THE IQSY
I. B. Biybosunov and K. A. Karimov *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 1-17 refs (For availability see N73-26363 17-13)
CSCL 04A

Results of measurements during the period from 1964 to 1965 on air mass circulation are presented. Author

N73-26365* Translation Consultants, Ltd., Arlington, Va.
THE USE OF TWO SPACED RADARS TO MEASURE METEOR DRIFTS c30
K. A. Karimov and V. V. Sidorov *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 18-27 refs (For availability see N73-26363 17-13)
CSCL 03B

Radar was used in Frunze in 1964 and 1965 to study meteors. The study was made to evaluate the accuracy of wind parameters measured in the meteor region of the atmosphere for small samples and unknown altitudes, as well as to evaluate the effect of using different space and time averaging methods on the accuracy of results obtained. Author

N73-26366* Translation Consultants, Ltd., Arlington, Va.
ONE DIMENSIONAL EXPANSION OF A METEOR TRAIL c30
N. A. Arkabayev *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 28-33 refs (For availability see N73-26363 17-13)
CSCL 03B

A mathematical analysis is made of the initial stage of expansion of hot vapors and gases in a meteor trail. Author

N73-26367* Translation Consultants, Ltd., Arlington, Va.
MEAN MONTHLY CHARACTERISTICS OF THE WIND REGIME
K. A. Karimov, V. Ya. Ogurtsov, and V. V. Sidorov *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 34-40 refs (For availability see N73-26363 17-13)
CSCL 04A

The mean characteristics of regular wind patterns were studied to ascertain the differences between true mean monthly values of wind characteristic parameters and the mean values obtained for 24-hours, or from methods used to average values for several days at a time. Author

N73-26368* Translation Consultants, Ltd., Arlington, Va.
A RADAR VARIANT FOR A METEORIC WIND PATROL c30
K. A. Karimov, V. D. Kostromin, and V. Ya. Ogurtsov *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 41-49 refs (For availability see N73-26363 17-13)
CSCL 03B

The development of SOM-3 radar system to study the density of meteor material radiant points in the celestial hemisphere and atmospheric circulation is described. Author

N73-26369* Translation Consultants, Ltd., Arlington, Va.
SECTOR RADIO MEASUREMENTS OF METEOR TRAIL DRIFTS BY LOW FREQUENCY RADAR TRANSMISSIONS c30
K. A. Karimov and V. Ya. Ogurtsov *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 50-56 refs (For availability see N73-26363 17-13)
CSCL 03B

The use of the sector method to record meteor trail drifts by radars using a sampling rate of F sub r = 100 to 200 pps is described. Author

N73-26370* Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF DIFFUSION IN THE METEOR ZONE c30
A. Ryskulov *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 57-60 refs (For availability see N73-26363 17-13)
CSCL 03B

The results of the measurement of the coefficient of ambipolar diffusion in the meteor zone are presented. Author

N73-26371* Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF THE PARAMETER s c30
V. D. Kostromin *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 61-75 refs (For availability see N73-26363 17-13)
CSCL 03B

Experimental data for determining the parameter s, which characterizes the distribution of meteoric bodies in terms of mass, are presented. Author

N73-26372* Translation Consultants, Ltd., Arlington, Va.
RESONANCE EFFECTS DURING SCATTERING AND ABSORPTION OF RADIO WAVES IN MODELS OF TRAILS OF FAST MOVING BODIES IN THE IONOSPHERE
L. A. Zhizhimov *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 66-72 refs (For availability see N73-26363 17-13)
CSCL 04A

A mathematical analysis is made of resonance effects in meteor trails during radio wave scattering and absorption. Author

N73-26373* Translation Consultants, Ltd., Arlington, Va.
THE EFFECT OF MOUNTAIN BARRIERS IN THE PATH OF METEOR PROPAGATION OF RADIO WAVES c07
N. N. Kalinina *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 73-80 ref (For availability see N73-26363 17-13)
CSCL 20N

The effect of mountains in the propagation path on the propagation of radio waves by meteors is discussed. The results are compared with propagation paths across plains. Author

N73-26374* Translation Consultants, Ltd., Arlington, Va.
A GRAPHICAL METHOD FOR ESTABLISHING THE ACTIVE CURVE OF A METEOR RADIANT POINT ON A GIVEN PATH c30
N. N. Kalinina *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 81-89 refs (For availability see N73-26363 17-13)
CSCL 03B

A graphical method for determining the positions of reflecting points of the active curve of a meteor radiant point is described. Author

N73-26375*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROPOSED GRAVITY-GRADIENT DYNAMICS EXPERIMENTS IN LUNAR ORBIT USING THE RAE-B SPACECRAFT
David L. Blanchard and Harvey Walden May 1973 39 p refs (NASA-TM-X-66271; X-580-73-158) Avail: NTIS HC $4.00 CSCL 08N

A series of seven gravity-gradient dynamics experiments is proposed utilizing the Radio Astronomy Explorer (RAE-B) spacecraft in lunar orbit. It is believed that none of the experiments will impair the spacecraft structure or adversely affect the continuation of the scientific mission of the satellite. The first experiment is designed to investigate the spacecraft dynamical behavior in the absence of libration damper action and inertia. It requires stable gravity-gradient capture of the spacecraft in lunar orbit with small amplitude attitude librations as a prerequisite. Four subsequent experiments involve partial retraction, ultimately followed by full redeployment, of one or two of the 230-meter booms forming the lunar-directed Vee-antenna. These boom length change operations will induce moderate amplitude angular librations of the spacecraft. Author

N73-26376*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLATE MOTION AND THE SECULAR SHIFT OF THE MEAN POLE
Han-Shou Liu, L. Carpenter, and R. W. Agreen Jun. 1973 15 p refs Submitted for publication
(NASA-TM-X-66272; X-592-73-162) Avail: NTIS HC $3.00 CSCL 08E

The global plate motion indicates that changes in the products of inertia of the earth due to tectonic plate movement may provide a secular shift of the mean pole. A mathematical procedure for calculating this shift based on the plate theory is presented. Explicit expressions were obtained for the dependence of the secular polar shift on the dimensions and locations of the plate boundaries. Numerical results show that the secular motion of the mean pole is 0.0002 sec/year in the direction of 67 W. Hence, it is deduced that the influence of the plate motion on the secular polar shift may account for 10% of the observed value. Author

N73-26377*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONTRIBUTIONS TO NATIONAL GEODETIC SATELLITE PROGRAM: GLOBAL CORRELATIONS
M. A. Khan Jun. 1973 11 p refs Submitted for publication (NASA-TM-X-66274; X-592-73-174) Avail: NTIS HC $3.00 CSCL 08E

Various forms of geophysical information as indicators of the physical properties of the planet are studied. It is useful to study the interrelationships of these various geophysical parameters in an attempt to determine whether they are generated by the same mechanism and if not, to assess the association of the various generating mechanisms. The formulas for studying such correlations are summarized. Author

N73-26378*# Alabama A & M Univ., Normal.
INVESTIGATION OF WATER QUALITY PARAMETERS AT SELECTED POINTS ON THE TENNESSEE RIVER Semiannual Report
1 Jun. 1972 13 p
(Grant NGR-01-001-018)
(NASA-CR-133089) Avail: NTIS HC $3.00 CSCL 08H

The thermal and water quality parameters in the vicinity of Widows Creek Steam Generation Plant were investigated. The water quality analysis and temperature profiles are presented for 24 sampling sites. F.O.S.

N73-26379# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE NO. 301
29 May 1973 93 p refs Transl. into ENGLISH from various Soviet articles
(JPRS-59136) Avail: NTIS HC $6.75

Translations and abstracts of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports are presented. Published details of Soviet space spectaculars are included. Author

N73-26380*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SAN MARCO 3 NEUTRAL ATMOSPHERE COMPOSITION EXPERIMENT
D. T. Pelz, G. P. Newton, W. T. Kasprzak, and T. D. Clem May 1973 20 p refs
(NASA-TM-X-66269; X-623-73-142) Avail: NTIS HC $3.00 CSCL 03B

The experimental instrumentation of the San Marco 3 satellite is described along with the calibration and operation. The instrumentation for the following experiments was included: an air density experiment for measuring the instantaneous drag force, and thus the neutral particle total mass density; a neutral atmosphere composition experiment for measuring the densities of helium, atomic and molecular oxygen, molecular nitrogen and argon; and a neutral atmosphere temperature experiment to determine the gas kinetic temperature by measuring molecular nitrogen density variations in an orificed spherical chamber as a function of angle of attack. F.O.S.

N73-26381# Lockheed Missiles and Space Co., Palo Alto, Calif.
DIRECT MEASUREMENTS OF THE ION DRIFT VELOCITY IN THE UPPER IONOSPHERE DURING MAGNETIC STORMS 1: METHODOLOGICAL QUESTIONS AND SOME MEASUREMENT RESULTS IN A MAGNETICALLY-QUIET TIME
Iu. N. Galperin, V. N. Ponomarev, and A. G. Zosimova [1973] 14 p refs Transl. into ENGLISH from Kosmich. Issled., Akad. Nauk SSSR (Moscow), v. 11, no. 2, 1973 p 273-283
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The asymmetry of the incoming ion flux due mainly to the drift motions of the ionospheric plasma under the effect of an electric field was measured in October and November 1967 on the Cosmos - 187. The geometry and methodology of measurements from a satellite oriented along the velocity vector are considered. Oscillations of the satellite orientation relative to the velocity vector, and possibly, also asymmetry of the incoming flux related to the geomagnetic field can induce the main error in the measurements. Author

N73-26382*# Chicago Univ., Ill.
AN ANALYTIC FORMULA FOR HEATING DUE TO OZONE ABSORPTION
Richard S. Lindzen and Douglas I. Will Aug. 1972 13 p refs
(Grants NGR-14-001-193; NSF GA-25904)
(NASA-CR-132778) Avail: NTIS HC $3.00 CSCL 04A

An attempt was made to devise a simple expression or formula to describe radiative heating in the atmosphere by ozone

absorption. Such absorption occurs in the Hartley, Huggins, and Chappuis bands and is only slightly temperature and pressure dependent. E.H.W.

N73-26383*# Chicago Univ., Ill.
EQUIVALENT GRAVITY MODES - AN INTERIM EVALUATION
Richard S. Lindzen and Siu-shung Hong Jan. 1972 29 p refs
(Grants NGR-14-001-193; NSF GA-25904)
(NASA-CR-132779) Avail: NTIS HC $3.50 CSCL 04A

The behavior of the main solar semidiurnal tidal mode in a dissipative atmosphere is studied both in a rotating spherical atmosphere and by means of the equivalent gravity mode approximation. Coefficients are chosen to crudely simulate the effects of molecular viscosity and conductivity. Major findings are: (1) Below 130 km, where friction is unimportant, equivalent gravity mode results are, for all practical purposes, identical to those at the equator obtained from a spherical calculation. (2) Above 130 km amplitudes over the equator obtained from the spherical calculation are about 30 percent smaller than those obtained from the equivalent gravity mode calculations. Also, there is a 15 deg (1/2 hour) difference in phase. (3) The amplitude reduction over the equator, is associated with a broadening of the latitude distribution of amplitude for the oscillatory pressure and temperature fields within the thermosphere. There is also significant variation of phase with latitude within the thermosphere. Associated with the above variations are significant changes in the latitude distribution of horizontal velocity within the thermosphere. Author

N73-26384*# Chicago Univ., Ill.
WAVE-MEAN FLOW INTERACTIONS IN THE UPPER ATMOSPHERE
Richard S. Lindzen [1973] 40 p refs
(Grants NGR-14-001-193; NSF GA-25904)
(NASA-CR-132776) Avail: NTIS HC $4.00 CSCL 04A

The nature of internal gravity waves is described with special emphasis on their ability to transport energy and momentum. The conditions under which these fluxes interact with the mean state of the atmosphere are described and the results are applied to various problems of the upper atmosphere, including the quasi-biennial oscillation, the heat budget of the thermosphere, the general circulation of the mesosphere, turbulence in the mesosphere, and the 4-day circulation of the Venusian atmosphere. Author

N73-26385*# Chicago Univ., Ill.
THE EFFECT OF PHOTOCHEMICAL MODELS ON CALCULATED EQUILIBRIA AND COOLING RATES IN THE STRATOSPHERE
Donna Blake and Richard S. Lindzen (Harvard Univ.) [1973] 90 p refs
(Grants NGR-14-001-193; NSF GA-25904; NSF GA-33990X)
(NASA-CR-132777) Avail: NTIS HC $6.50 CSCL 04A

Simplified models were developed for radiative heating and cooling and for ozone photochemistry in the region 22-60 km. The latter permit the inclusion of nitrogen and hydrogen reactions in addition to simple oxygen reactions. The simplicity of the scheme facilitates the use of a wide variety of cooling and reaction rates. It is shown that joint radiative-photochemical equilibrium is appropriate to the mean state of the atmosphere between 35 and 60 km. The relaxation of perturbations from joint radiative-photochemical equilibrium was also investigated. In all cases the coupling between temperature dependent ozone photochemistry and radiation lead to a reduction of the thermal relaxation time from its purely radiative value. The latter, which amounts to about 10 days, is reduced to 2-4 days at heights of 31-35 km. This greatly enhances the dissipation of waves traveling through the stratosphere. Author

N73-26386*# Kanner (Leo) Associates, Redwood City, Calif.
CRITERIA FOR OPTICAL CLASSIFICATION OF LANDSCAPES
Yu. S. Tolchelnikov and T. M. Khazanova Washington NASA Jun. 1973 10 p refs Transl. into ENGLISH from "Kriterii Opticheskoy Klassifikatsiy Landshaftov" Moscow Presented at the meeting of the Soviet-American Working Group on Remote Sensing of Natural Environment from Space, 12-17 Feb. 1973
(Contract NASw-2481)
(NASA-TT-F-14970) Avail: NTIS HC $3.00 CSCL 08F

A set of quantitative criteria was developed that can be used for the classification of landscapes into taxonomic groups on the basis of their optical properties. The classification is based on the following morphological properties of elements in the landscape: color, dimension and form, texture. Some of the parameters used to characterize the optical properties of elements in the landscape are the mean coefficient of brightness, a parameter characterizing the angular distribution of reflectance, and the mean dimension of components making up an element. The criteria presented can be used to develop a concrete scheme for the optical classification of landscapes with the aid of remote sensing methods. Author

N73-26387*# Scientific Translation Service, Santa Barbara, Calif.
USE OF SPACE IMAGES FOR GLACIER INVESTIGATIONS IN MOUNTAINOUS REGIONS
V. I. Kravtzova and I. A. Labutina Washington NASA Jul. 1973 32 p refs Transl. into ENGLISH of "Ispolzovaniye Kosmicheskikh Snimkov dlya Glyatsiologicheskogo Izucheniya Gornykh Rayonov", Acad. of Sci. USSR, Inst. of Space Res., Moscow, report, 1973 30 p Presented at Meeting of the Soviet-Am. Working Group on Remote Sensing of Nat. Environment from Space, Moscow, 12-17 Feb. 1973
(Contract NASw-2483)
(NASA-TT-F-14969) Avail: NTIS HC $3.75 CSCL 08L

The use of space imagery to study glaciological objects, and in particular the snow and glacier complexes in mountains, is discussed. It is shown that orbital photographic pictures have higher ground resolution and may be used to study glaciers. Author

N73-26388*# Scientific Translation Service, Santa Barbara, Calif.
STUDY OF THE LANDSCAPE STRUCTURE OF THE EARTH'S STRUCTURE ON THE BASIS OF SPACE PHOTOGRAPHY
V. A. Nikolayev Washington NASA Jun. 1973 11 p Transl. into ENGLISH of "Izucheniye Landshaftnoy Struktury Zemnoy Poverkhnosti po Materialam Kosmicheskoy Fotossemki", Acad. of Sci. USSR, Inst. of Space Res., Moscow, report, 1973 12 p Presented at Meeting of the Soviet-Am. Working Group on Remote Sensing of Nat. Environment from Space, Moscow, 12-17 Feb. 1973
(Contract NASw-2483)
(NASA-TT-F-14968) Avail: NTIS HC $3.00 CSCL 08E

The advantages of space photography over regular aerial photography are pointed out. They include the ability to integrate small details of the morphological structure of the landscape, while showing its main structural features. The conclusion is reached that space photographs have provided proof of the fractional differentiation of the landscape and the objective existence of landscapes and other natural geosystems. Author

N73-26389*# Scientific Translation Service, Santa Barbara, Calif.
THE EXPLORATION OF THE NATURAL LANDSCAPE WITH THE HELP OF METEOROLOGICAL SATELLITES
Boris S. Vinogradov Washington NASA Jul. 1973 17 p refs Transl. into ENGLISH from Geographische Berichte (East Germany), v. 62, no. 1, 1972 p 1-12
(Contract NASw-2483)
(NASA-TT-F-14965) Avail: NTIS HC $3.00 CSCL 22C

The applications of satellite TV pictures are discussed. Television pictures from meteorological satellites may be used in oceanology for studying the currents (according to cloud indicators), the motion of the sea (on the basis of the type of reflections caused by the sun) and of the drift ice (according to the color and texture of the picture). In hydrology, aside from the investigation of snow-covered areas, they have essential importance for studying large river valleys, lakes and dam structures. In geology and geomorphology such photographs may be valuable for studying extended tectonic structures and larger relief forms. One of the most promising fields is pedology as well as geobotany, where television pictures are used for improvement and correction of maps in medium to small scale.

for studying the dynamics and seasonal rhythm of vegetation as well as for observing big fires and dust storms. Author

N73-26390*# Scientific Translation Service, Santa Barbara, Calif.
ASPECTS OF THE INTERNATIONAL EXPLORATION OF NOCTILUCENT CLOUDS
W. Schroeder Washington NASA Jun. 1973 10 p refs Transl. into ENGLISH from Z. Meteorol. (East Germany), v. 22, no. 6-7, 1971 p 229-232
(Contract NASw-2483)
(NASA-TT-F-14950) Avail: NTIS HC $3.00 CSCL 03B

After historical remarks, some features of international cooperation to advance the noctilucent clouds are described. Increased cooperation of scientists of all countries is necessary for research work of noctilucent clouds and physics of the mesosphere. Author

N73-26391*# Techtran Corp., Silver Spring, Md.
LASER SOUNDING OF THE ATMOSPHERE
V. Ye. Zuyev Washington NASA Jun. 1973 19 p Transl. into ENGLISH from Priroda (USSR), no. 10, Oct. 1972 p 86-93
(Contract NASw-2485)
(NASA-TT-F-14948) Avail: NTIS HC $3.00 CSCL 04A

Laser sounding of the atmosphere is discussed as a good prospective method for forecasting weather and for determining levels of atmospheric pollution. An explanation of the method is provided, with examples drawn from experience in determining the locations and concentrations of water vapor, sodium vapor and nitrogen. A plea is made that the technique and equipment be more vigorously developed. Author

N73-26392*# Scripta Technica, Inc., Washington, D.C.
SMALL-SCALE GEOBOTANICAL ZONING AND CARTOGRAPHY BASED ON SPACE PHOTOGRAPHY OF THE EARTH
B. V. Vinogradov NASA Washington Jul. 1973 25 p refs Transl. into ENGLISH from the publ. "Geobotanicheskoye Kartografirovaniye" Moscow, Nauka, 1971, p 3-18
(Contract NASw-2484)
(NASA-TT-F-14976) Avail: NTIS HC $3.25 CSCL 08B

Space photography is discussed as a new and prospective science for use in geobotanical mapping. Emphasis is placed on the fact that this field has received little study. Using predominantly American data, several examples of geobotanical mapping are provided, with an interpretation. Author

N73-26393*# Scientific Translation Service, Santa Barbara, Calif.
REPORT OF STUDY ON VEGETATION, SOIL AND LAND USE AT KEY SITES
B. V. Vinogradov Washington NASA Jun. 1973 6 p Transl. into ENGLISH of "Otchet po Programme SSSR po Izucheniyu Rastitelnosti, Pochvy i Ispolzovaniya zemel na Klyuchevykh Uchastkakh" Acad. of Sci., Inst. of Space Res., Moscow, report, 1973 4 p Presented at Meeting of Soviet-Am. Working Group on Remote Sensing of Natural Environment from Space, Moscow, 12-17 Feb. 1973
(Contract NASw-2483)
(NASA-TT-F-14967) Avail: NTIS HC $3.00 CSCL 08M

A description is given of remote sensing methods to study the vegetation, soil, and agricultural use of the land. Photographs obtained by Soyuz-9, Salyut, and Meteor spacecraft were analyzed for this purpose. Author

N73-26394*# System Planning Corp., Arlington, Va.
EARTH RESOURCES SURVEY APPLICATIONS OF THE SPACE SHUTTLE SORTIE MODE Final Report
Ravi D. Sharma, William L. Smith, and Fred J. Thomson 11 May 1973 103 p refs
(Contract NASw-2446)
(NASA-CR-132207; Rept-113) Avail: NTIS HC $7.25 CSCL 22A

The use of the shuttle sortie mode for earth observation applications was investigated and its feasibility for applied research and instrument development was appraised. The results indicate that the shuttle sortie missions offer unique advantages and that specific aspects of earth applications are particularly suited to the sortie mode. Author

N73-26395# Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.
CONJUGATE POINTS [COLLOQUE FRANCO-SOVIETIQUE POINTS CONJUGUES]
5 Apr. 1973 54 p refs In FRENCH Proc. of the Franco-Soviet Colloq., Aussois, France, 1973
(CEP-AG-10/73) Avail: NTIS HC $4.75

Analyses of Pc1 and Pc3 type geomagnetic micropulsations are the main subjects of discussion. How the magnetospheric proton density can be determined from observations of Pc3 micropulsations is shown. The geomagnetic latitude distribution of stationary Pc3 micropulsation statistical properties is derived from power spectra cross correlations. The polarization of Pc1 micropulsations was observed in the same hemisphere and at conjugate points. For individual titles, see N73-26396 through N73-26402.

N73-26396 Grenoble Univ. (France). Centre d'Etude des Phenomenes Aleatoires et Geophysiques.
GEOMAGNETISM. MAGNETOSPHERIC PROTON DENSITY DETERMINATION FROM OBSERVATIONS OF TYPE Pc3 GEOMAGNETIC PULSATIONS [MAGNETISME TERRESTRE. DETERMINATION DE DENSITE DE PROTONS DANS LA MAGNETOSPHERE A PARTIRD 'OBSERVATIONS DE PULSATIONS GEOMAGNETIQUES DÙ TYPE PC3]
Nelly Cavaciuti, Francois Glangeaud, and J.-L. Lacoume *In its* Conjugate Points 5 Apr. 1973 p 5-11 refs In FRENCH (For availability see N73-26395 17-13)

Magnetospheric proton density distributions were determined by calculating the terrestrial magnetic force lines situated in the same meridian plane. The profiles obtained from satellite observations and the distribution in latitude of the periods observed from the ground were found to satisfy the conditions of resonance mentioned. ESRO

N73-26397 Grenoble Univ. (France).
METHODS OF EXPERIMENTAL STUDIES OF THE Pc3 [METHODES D'ETUDES EXPERIMENTALES DES PC3]
Nelly Cavaciuti, F. Glangeaud, and J.-L. Lacoume *In its* Conjugate Points 5 Apr. 1973 p 16-22 refs In FRENCH (For availability see N73-26395 17-13)

The stationary statistical characteristics of Pc3 geomagnetic micropulsations were investigated with regard to their geomagnetic latitude distribution. The Pc3 micropulsations are considered as random processes. A spectral power densities study shows that the energy is located in a certain number of frequency bands, which can be common to two distinct stations. The cross correlation functions indicate that a line of force is associated with each wave packet; the observation zone of the same packet is centered at the foot of this line. ESRO

N73-26398 Grenoble Univ. (France).
POLARIZATION IN CONJUGATE POINTS [POLARISATION EN POINTS CONJUGUES]
F. Glangeaud, S. Perraut, and C. DeVildary *In its* Conjugate Points 5 Apr. 1973 p 23-27 refs In FRENCH (For availability see N73-26395 17-13)

The polarization of Pc1 micropulsations was observed in the same hemisphere and at conjugate points. The polarization, as observed on earth, is defined as the variation of the field B in horizontal plane beneath the observer. It is shown that the polarization is likely to be different between neighboring stations. If the conjugation of the utilized stations was not effected perfectly, there may be cases of Pc1s where the polarization found with the ground does not satisfy the classical laws of conjugation. ESRO

N73-26399 Grenoble Univ. (France).
SOME ASPECTS OF ANALYSIS BY CORRELATION [CERTAINS ASPECTS D'ANALYSE PAR CORRELATION] c19
W. Kofman *In its* Conjugate Points 5 Apr. 1973 p 28-34 refs In FRENCH (For availability see N73-26395 17-13)

The principal error sources in estimating the correlation function of random processes were investigated. Statistical error

is evaluated for three practical cases: white noise, Gaussian noise, and sine waves with random phase. Another error source is the quantizing error in sampling with infinite levels, and with finite levels. ESRO

N73-26400 Grenoble Univ. (France).
ESTIMATION OF A SPECTRAL DENSITY [ESTIMATION D'UNE DENSITE SPECTRALE] **c07**
D. Baudois *In its* Conjugate Points 5 Apr. 1973 p 35-39 In FRENCH (For availability see N73-26395 17-13)

Three methods for estimating random signal power spectral density are discussed. The first method is based on filtering with a bandpass filter. The second method utilizes the fluctuating spectrum, obtained by Fourier transformations of a signal sample. The third method is based on the autocorrelation function. For each approximation, an analysis is made of errors committed. ESRO

N73-26401 Grenoble Univ. (France).
Pc1 DETECTION AND ATTEMPT AT MEASURING AUTOMATICALLY THEIR DISPERSION [RECONNAISSANCE DE PC1 ET TENTATIVE DE MESURE AUTOMATIQUE DE LEUR DISPERSION]
C. Drighes, F. Glangeaud, A. Silvent, and A. VanderHam *In its* Conjugate Points 5 Apr. 1973 p 40-44 In FRENCH (For availability see N73-26395 17-13)

The properties of equipment for real time or off-line evaluation of Pc1 micropulsation characteristics are described. The Pc1 characteristics are measured by approximation with known synthetic signals. Signals with characteristics similar to Pc1 are produced using a numerical method and are compared with the real signals. Two zero methods are proposed: creating filters adapted to the synthetic signals, or measuring the frequency distance between the synthetic and real signals. ESRO

N73-26402 Grenoble Univ. (France).
ADAPTED FILTER FOR FADING DISPERSIVE Pc1 SIGNALS. OPTICAL DEVELOPMENT [FILTRE ADAPTE A DES SIGNAUX DE FREQUENCE DEFERLANTE DU TYPE PC1. REALISATION OPTIQUE]
J. Lienard *In its* Conjugate Points 5 Apr. 1973 p 45-52 In FRENCH (For availability see N73-26395 17-13)

An optical method for measuring the dispersion of coherent wave packets produced by Pc1 geomagnetic micropulsations is proposed. A photographic film, the transparency of which is a function of the signal amplitude, forms a diffraction grating. Each wave packet corresponds to a focusing point; the distance of the focusing plane gives the dispersion; and the position of the point in the plane permits dispersion localization in the frequency-time diagram. This process, which makes use of coherent light, employs an adapted filter in cases where the wave packet is composed of various wave trains without phase relation. By modifying the (coherent) light source, estimation of the coherence length is possible. ESRO

N73-26403# Atomic Energy Commission, New York. Health and Safety Lab.
WORKSHOP ON NATURAL RADIATION ENVIRONMENT
James E. McLaughlin, ed. Aug. 1972 80 p refs Conf. held at New York, Mar. 1972
(HASL-269) Avail: NTIS

The ARMS system includes a Twin Bonanza Beechcraft, an array of radiation sensing instrumentation, a flying crew, and scientific backup in the application of this system to a wide variety of radiological measurements. These airborne gamma radiation surveys, flown at altitudes of 300 to 500 feet above the terrain, provide much definitive information about the terrestrial radiation environment, from both natural and man made sources. Other programs were concerned with measuring the terrestrial dose reduction due to snow cover and ground moisture. The primary use of the terrestrial radiation survey data is: to provide a baseline in case of an accident of any type; to aid in evaluating the impact of nuclear facilities on their environment; and to document on a broad scale the background radiation environment. Most of the survey data are stored on magnetic tape. NSA

N73-26404# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
INFLUENCE OF THE IONOSPHERE ON MAGNETOSPHERIC FLOW, PART 1.
Erik T. Karlson Dec. 1972 40 p refs
(TRITA-EPP-72-22-pt-1) Avail: NTIS HC $4.00

A model of stationary, adiabatic plasma flow in the magnetosphere, where interaction with the ionosphere is taken into account, and where it is assumed that the magnetic field lines are equipotentials, is presented. The model is then compared to a previous model where the field-alignment currents are negligible. The similarity of flows for these two extreme cases makes it possible to draw conclusions about the structure of stationary, adiabatic plasma flow in the magnetosphere for the intermediate case, found in nature, where both field-aligned currents and longitudinal electric fields are important. ESRO

N73-26405# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
THEORY OF TIME VARYING ATMOSPHERIC ELECTRIC FIELDS AND SOME APPLICATIONS TO FIELDS OF IONOSPHERIC ORIGIN
R. Bostroem, U. Fahleson, L. Olausson, and G. Hallendal Jan. 1973 52 p refs
(TRITA-EPP-73-02) HC $4.75

The propagation of slowly varying electric disturbances in the atmosphere was investigated theoretically. The approach used was to solve the continuity equation for the electric current assuming the electric field to be a time varying potential field. An earlier result indicating that the temporal variation of the electric field at each point is governed by the local relaxation time was shown to be false. Atmospheric fields of ionospheric origin were studied. A general analytical solution is presented and examples of numerically computed solutions are given. It was concluded that ionospheric field variations give rise to substantial disturbances in the atmospheric electric field, but at low altitudes they are hard to distinguish from disturbances of meteorological origin. Author (ESRO)

N73-26406# Stockholm Univ. (Sweden). Inst. of Meteorology.
SOUNDING ROCKET EXPERIMENT FOR THE INVESTIGATION OF HIGH-LATITUDE SUMMER ATMOSPHERIC CONDITIONS BETWEEN 60 AND 110 km ESRO EXPERIMENT (R-175, PAYLOAD C-59)
G. Witt, N. Wilhelm, J. Stegman, A. P. Williams, B. Holback (Uppsala Ionospheric Obs.), E. Llewellyn (Saskatchewan Univ.), and A. Pedersen (ESTeC) 17 Dec. 1971 41 p refs Sponsored in part by ESRO
(Contracts RN-1-36; RN-1-37)
(AP-7) Avail: NTIS HC $4.25

As part of a series of experiments for the investigation of the structure, composition, and ionization of the mesosphere and D region, two sounding rockets were launched in northern Sweden on July 31 and August 1, 1971, in presence of well developed displays of noctilucent clouds. A short account of the scientific background to the experiment, a description of the payload with emphasis on the instrumentation including photometric equipment for measuring light scattering, emission, and absorption as well as instruments for measuring the concentration of electrons and ions as function of altitude are contained. Reduced data are presented. ESRO

N73-26407# Stockholm Univ. (Sweden). Inst. of Meteorology.
MODEL STUDIES OF THE BALTIC SEA
Bert Bolin 26 Nov. 1971 23 p refs
(GH-4) Avail: NTIS HC $3.25

Exchange processes in the Baltic Sea were studied with the aid of a simple two box model. Water and salinity balance requires that certain relations between exchange through the Danish Sounds and the vertical exchange across the halocline be satisfied. It is possible to restrict further the possible combinations of such exchange by studying the change of the tritium content of the Baltic that has occurred over the last fifteen years. With the aid of these results the budget of oxygen, phosphorus and organic material was studied, including the production and decomposition of organic compound and the effects of gravitational settling of dead organic matter. The results clearly demonstrate the sensitivity of this water body to a rather modest release of waste products from human activity. Author (ESRO)

N73-26408# Stockholm Univ. (Sweden). Inst. of Meteorology.
A STUDY OF THE SULFUR BUDGET FOR THE ATMOSPHERE OVER NORTHERN EUROPE
Henning Rodhe 8 Oct. 1971 35 p refs Sponsored by Natl. Swed. Environ. Protect. Board
(AC-17) Avail: NTIS HC $3.75

The atmospheric sulfur budget for northern Europe is discussed and compared with global averages. It is found that in this area the anthropogenic sulfur sources outweigh natural sources. A comparison between deposition and emission of sulfur within different regions in northern Europe shows that the dispersion of sulfur has a continental character; i.e since, on average, sulfur is transported more than 1000 km before it is deposited, one country can be appreciably influenced by another, in this respect. A model for the variation of deposition with distance from a source is suggested. Application of this model gives an estimated turnover time for anthropogenic sulfur of two to four days. As a qualitative example, the distribution between various sources of the sulfur deposition in Sweden has been estimated. It is found that about half of the sulfur orignates from foreign anthropogenic emissions, while the other half is caused by Swedish emissions and a natural background. Just as Sweden is influenced by the surrounding industrial countries, it is furthermore clear that a large part of the sulfur emitted in Sweden is deposited outside the country. Author (ESRO)

N73-26409# Stockholm Univ. (Sweden). Inst. of Meteorology.
CARBON DIOXIDE CONCENTRATION IN THE UPPER TROPOSPHERE AND LOWER STRATOSPHERE, PART 3
Walter Bischof Jan. 1972 14 p refs
(Contract SWEDSRC-0223-051)
(AC-24-Pt-3) Avail: NTIS HC $3.00

Air samples collected from commercial aircraft from 1962 to 1971 within the Northern Hemisphere are presented. A data separation shows the change in amplitude and phase between upper trosposphere and lower stratosphere. Author (ESRO)

N73-26410# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA. DATA SUMMARY 72/10-12, OCTOBER-DECEMBER 1972
L. Liszka, ed. Dec. 1972 69 p Prepared jointly with European Space Sounding Rocket Range
Avail: NTIS HC $5.50

Results of ground-based measurements of upper atmosphere variables recorded at Kiruna (Sweden) from October to December 1972 are summarized. Recorded data includes K indices, ionospheric absorption, diurnal variation of cosmic noise absorption, and standard magnetograms. ESRO

N73-26411# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Aug. 1972 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, AOUT 1972]
Aug. 1972 27 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during August 1972 are presented. ESRO

N73-26412# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Sep. 1972 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, SEPTEMBRE 1972]
Sep. 1972 27 p In FRENCH and DUTCH
Avail: NTIS HC $3.50

Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during September 1972 are presented. ESRO

N73-26413# Army Coastal Engineering Research Center, Washington, D.C.
CERC BULLETIN AND SUMMARY OF RESEARCH PROGRESS, FISCAL YEARS 1970 - 1971, VOLUME 4
Mar. 1973 56 p refs
(AD-759283) Avail: NTIS CSCL 13/2

The bulletin is a summary of CERC's progress in coastal engineering research for FY's 1970-71. Included are summaries of research and development programs on wind-wave action in coastal waters, shore processes, long-period waves and surges, inlet and estuary dynamics, coastal ecology studies, shore protection, offshore structures, and environmental data collection. Reports on CERC support activities include ADP, and technical and administrative services. CERC publications for FY's 70-71 are listed. Author (GRA)

N73-26414# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFRARED MAPPING OF LARGE FOREST FIRES
V. I. Binenko, L. N. Dyachenko, and K. Ya. Kondratev 14 Mar. 1973 16 p refs Transl. into ENGLISH from Radiats. Issled. v Atmos. (USSR), no. 275, 1972 p 237-244
(AD-758613; FTD-HT-23-1866-72) Avail: NTIS CSCL 02/6

Aerial studies on finding and mapping large-scale forest fires by the IR photography method were conducted in the summer of 1970 in Siberia. In studying the possibilities of using IR technology to discover forest fires from an aircraft IR photographs were made of forest fires which were entirely or partially hidden by a thick smoke screen. GRA

N73-26415# Stockholm Univ. (Sweden).
RESULTS FROM TWO SCATTERED LIGHT PHOTOMETERS ON BOARD AN AFCRL NOCTILUCENT CLOUD PARTICLE COLLECTING PAYLOAD Final Report
Georg Witt and Nathan Wilhelm 8 May 1972 48 p refs
(Contract F61052-67-C-0068)
(AD-760149; MISU-AP-9; AFCRL-72-0538) Avail: NTIS CSCL 04/1

A pair of scattered radiance polarization photometers were designed and built to supplement a noctilucent cloud (NLC) particle collecting experiment. The experiment was launched on August 8, 1970 in northern Sweden. The scientific background of the experiment is presented, and the technical design and calibration of the photometers is described. The basic theory, which relates the light scattering properties of NLC to the radiances measured by polarization photometers at two wavelengths, is also included. GRA

N73-26416# AeroChem Research Labs., Inc., Princeton, N.J.
UPPER ATMOSPHERIC CHEMICAL RELEASE TECHNIQUES Semiannual Report, 15 May - 31 Dec. 1972
H. S. Pergament, A. Fontijn, W. Felder, D. A. Hatzenbuhler, and C. J. Kau Feb. 1973 47 p refs
(Contract F30602-72-C-0420; ARPA Order 1649)
(AD-760141; AeroChem-TP-287; RADC-TR-73-67; SAR-1) Avail: NTIS CSCL 04/1

The results of preliminary upper atmosphere release package design studies are presented in this report; these include: a parametric series of thermochemical equilibrium calculations, pressure-time history calculations following steady burning and explosive releases and estimates of the position of atomic Fe vapor condensation onset during the expansion of Flashbulb combustion products to ambient pressure. Results of the latter calculations show that homogeneous nucleation will be frozen for Flashbulb combustion pressure less than about 10 atm. (Author Modified Abstract) GRA

N73-26417# Panametrics, Inc., Waltham, Mass.
HEAVY PARTICLE INDUCED IONIZATION RATES FOR PCA 69 Final Report, 30 Oct. 1970 - 30 Jun. 1972
Bach Sellers, Frederick A. Hanser, and Jean L. Hunerwadel Nov. 1972 70 p refs Sponsored in part by Defense Nuclear Agency
(Contract F19628-71-C-0086)
(AD-760138; AFCRL-72-0650) Avail: NTIS CSCL 04/1

During Operation PCA 69 proton and alpha particle fluxes in the approximate range 2-100 MeV were determined from measurements made on three Black Brant rockets launched at the following universal times: AJ17.602, 2 Nov/2020; AJ17.758, 3 Nov/0605; AJ17.617, 4 Nov/2308. General details of the particle detection system design are given, and the method of deducing the differential spectrum incident on the atmosphere from the measured altitude variation of the integral flux is

discussed. Specific ionization rate expressions are derived for heavy particle spectra of the form j(E, alpha) approximately(E to the minus n power) Cos(to the beta power) of alpha and presented in a manner applicable to any atmosphere. When the spectrum is assumed to extend to infinite energy, a simple analytic result is obtained that is applicable to that region of the atmosphere in which the atmospheric depth exceeds the range of the minimum energy particles contained in j(E, alpha). Altitude profiles of proton induced ionization rate are given for the launch time of each of the three rockets. Author (GRA)

N73-26418# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INDUCED MAGNETOSPHERIC ELECTRIC FIELDS Annual Report
W. P. Olson Mar. 1973 24 p refs
(Contract N00014-72-C-0233)
(AD-760058) Avail: NTIS CSCL 04/1

The goal of the research is to understand and quantitatively model electric fields induced in the magnetosphere by changes in the magnetospheric magnetic field. It will then be possible to self consistently study particle and field behavior in a dynamic model of the magnetosphere. The most important sources of induced electric fields in the magnetosphere are changes in the tail magnetic field associated with substorms and magnetic storms and the daily wobble of the earth's main field due to the inclination of the dipole axis to the earth's rotation axis. GRA

N73-26419# Lockheed Missiles and Space Co., Palo Alto, Calif.
DEFINITION OF ENERGY INPUT: OPERATION ICE CAP Final Technical Report, 1 Mar. - 30 Sep. 1972
Robert D. Sears 1 Oct. 1972 58 p refs
(Contract DNA01-72-C-0134)
(AD-760042; LMSC-D311131; DNA-2985F) Avail: NTIS CSCL 04/1

Photometric and Image Intensified TV (IITV) measurements of auroral precipitation patterns and energy input were made at Poker Flats, Alaska in support of the 1972 Ice Cap series of rocket experiments. Photometric data was obtained on 4278A, 4861A and 6300A spectral bands using a 3-color photometer to define total energy input, proton precipitation flux, and F-region response to heat conducted energy input. A 3-beam photometer operating on 5577A, 5809A and 6300A was used to attempt to detect the presence of wavelike and/or turbulent disturbances in the D-, E- and F-regions. The IITV instrumentation operated at 4278A and 5577A wavelengths and was intended to develop high spatial and temporal resolution pictures of precipitating particle energy input. (Author Modified Abstract) GRA

N73-26420# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Sciences.
COMPUTATIONAL DIFFUSION IN ATMOSPHERIC BOUNDARY LAYER MODELS
Paul E. Long Jul. 1972 58 p refs
(Contract F19628-69-C-0092; AF Proj. 7922; Proj. THEMIS)
(AD-760122; AFCRL-72-0401; SR-4) Avail: NTIS CSCL 04/1

A study is made of the truncation error and stability of finite difference advection/diffusion schemes. Their truncation error may be conveniently interpreted as an additional diffusion term and a dispersive phase velocity. Both quantities are functions of the grid spacing, time step, wavelength of the Fourier component and of the differencing scheme itself. The Taylor series determination of the computational or implicit diffusion coefficient yields the first term of a perturbation series. Retaining only the first term is invalid for short wavelengths. A simple, exact method is presented which calculates the computational diffusion coefficient for all wavelengths for equations of constant coefficients. When physical, explicit diffusion is introduced into an advection equation, the effects of computational and explicit diffusion are generally not additive except for scales about an order of magnitude larger than the grid interval. The schemes studied are intended for use in one dimensional atmospheric boundary layer models, but the analysis can be extended to higher dimensions. (Author Modified Abstract) GRA

N73-26421# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
FIELD EVALUATION OF TIME-DEPENDENT GEODETIC DATA Physical Sciences Research Papers.
Theodore E. Wirtanen 26 Mar. 1973 20 p refs
(AF Proj. 7600)
(AD-760109; AFCRL-TR-73-0191; AFCRL-PSRP-544) Avail: NTIS CSCL 08/5

With the proliferation of new geodetic techniques involving time-dependent variables, it becomes increasingly difficult for the operational teams to answer to their own satisfaction the question: Are we getting meaningful data? The newly emerging theodolites and devices operating with photosensitive reticles are good examples of this. These devices will be disgorging an enormous amount of data consisting of time records of celestial events crossing various portions of the reticle. It appears that a quick evaluation of these time crossings to determine if they follow any generally acceptable pattern could easily be done using a type of differencing. This evaluation could be performed in a timely enough fashion to permit real-time evaluation of the data. This would minimize the need for site reoccupation at a later date. Author (GRA)

N73-26422# Emmanuel Coll., Boston, Mass.
MATHEMATICAL-MODEL PROGRAMS Final Report, 15 Oct. 1970 - 15 Feb. 1972
M. Patricia Hagan 30 Oct. 1972 24 p refs
(Contract F19628-71-C-0064; AF Proj. 7601)
(AD-760117; AFCRL-72-0674) Avail: NTIS CSCL 08/14

Programs were compiled to compare experimental data with mathematical models with respect to magnetic activity. Micropulsations were investigated and programs were written to compute the eigenperiod and modulus of decay, so the predicted results could be compared with experimental observations. This was a particularly difficult problem, because the dispersion relationship was a complex transcendental equation, and required a 2-part fit. The complex function was mermorphic with respect to its complex arguments, and so the Cauchy-Riemann conditions were applicable. The secular equation was expanded in a Taylor Series, and then the equation was cast in a form immediately amenable to the numerical analysis. The programs were written and can now be easily reformated, suitable for production basis on the CDC 6600. (Author Modified Abstract) GRA

N73-26423# Utah State Univ., Logan. Center for Research in Aeronomy.
IONOSPHERIC MODELING Quarterly Report
L. R. Megill 1973 12 p refs
(Contract N00014-67-A-0220-0004; ARPA Order 2266)
(AD-760044) Avail: NTIS CSCL 04/1

A computer code was developed that will calculate the time-varying, vertical ionization distribution between 100 and 500 kilometers altitude for the polar ionosphere. The code produces ionization from both the solar ultraviolet flux and by auroral electron precipitation down the geomagnetic field lines. The distribution of ionization into the various ion species is traced through ion-chemical reactions, which are specified by the user. At present, 66 reactions can be accommodated. The ion-chemical reactions form a set of production and loss terms, which can be folded into the species continuity equations to calculate the time variable species density. GRA

N73-26424# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
THEORETICAL ASPECTS OF ARTIFICIAL PLASMA INJECTION Final Report
John M. Cornwall and Michael Shulz 15 Jan. 1973 125 p refs Sponsored by DARPA and NOAA
(AD-760032; ATR-73(7279)-1) Avail: NTIS CSCL 04/1

The report contains detailed theoretical studies of several aspects of a program to stimulate electromagnetic cyclotron instabilities in the magnetosphere through cold plasma injection. This includes discussions of the dynamics of an artificially injected lithium cloud, ion-EMC wave growth rates in a lithium plasma, the effects of plasma inhomogeneities and some remarks on the Post-Rosenbluth instability in a high-beta two-ion plasma. Author (GRA)

N73-26425# Woods Hole Oceanographic Institution, Mass.
ADVANCED MARINE TECHNOLOGY Technical Progress Report, 1 Feb. - 31 Jul. 1972
Thomas C. Aldrich, Robert D. Ballard, Carl O. Brown, Bruce P. Luyendhk, Marvin J. McCamis, William M. Marquet, Joseph D. Phillips, Dave L. Porter, Allyn C. Vine, and Richard P. VonHerzen 28 Feb. 1973 85 p
(Contract N00014-71-C-0284; NR Proj. 293-008)
(AD-759992; WHOI-73-20) Avail: NTIS CSCL 13/10

The report is on the following projects in advanced marine technology: Submerged navigation and submersible instrumentation; Handling and transfer at sea; Bottom reconnaissance and a detailed site survey by research submersible; Near bottom magnetic studies using a deep submersible; Near bottom gravity studies from a deep submersible; Self contained deep sea rock drill; and Self contained ancillary modular platform. GRA

N73-26426# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
A MULTICHANNEL PULSE CODE MODULATION SYSTEM FOR DATA COLLECTION AND TRANSMISSION FROM OCEANOGRAPHIC BUOYS
Kenneth A. Morey 30 Mar. 1973 19 p
(Contract N00014-67-A-0204-0024; NR Proj. 083-236)
(AD-760336; Rept-73-3) Avail: NTIS CSCL 08/3

The report describes a multichannel pulse sampling system used with pulse type anemometers and current meters on an oceanographic buoy. The system was built to make it possible to transmit five cup anemometers and five current meter signals via two FM subcarrier channels. The system clock drives the sampling sequences and is also transmitted on a separate FM subcarrier channel. The system is designed with an on-line or delayed breakout capability and will interface with either analog or digital processing devices. The breakout system is described. Author (GRA)

N73-26427# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE GEOMAGNETIC FIELD (A REVISION OF CHAPTER 2, HANDBOOK OF GEOPHYSICS AND SPACE ENVIRONMENTS) Air Force Surveys in Geophysics.
David J. Knecht 26 Sep. 1972 133 p refs
(AF Proj. 7601)
(AD-759837; AFCRL-72-0570; AFCRL-AFSIG-246) Avail: NTIS CSCL 08/14

The survey summarizes what is known about the magnetic field of the earth, based on information available through 1971. Observed phenomena are described and interpreted in terms of the most widely accepted physical explanations. An overview of the geomagnetic field and its dynamic relationship with its terrestrial and interplanetary environment is first presented as briefly as possible, followed by more detailed descriptions of geomagnetic measurements and experimental methods, precise current models and past behavior of the main field, regular variations in the field resulting from the motion of the earth, disturbance variations of the field produced by the interplanetary environment, and dynamic processes occurring in the outer magnetosphere. (Author Modified Abstract) GRA

N73-26428# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
THE IMPLEMENTATION OF THE PARTIAL REFLECTION EXPERIMENT AT THE SCOTIA FACILITY
John J. Portelli Apr. 1973 71 p refs
(Contract N00014-67-A-0385-0014; Grant NSF GA-13885)
(AD-760362; PSU-IRL-SCI-414) Avail: NTIS CSCL 04/1

The design and construction of an experimental system for receiving and recording echoes from the D-region of the ionosphere is described. A brief presentation of the theory of partially reflected echoes is included with emphasis on some of the more recent theoretical developments. Since partially reflected echoes are weak echoes, a sensitive receiving and recording system is necessary. Therefore, modifications were made to an existing antenna structure to permit duplex operation with this antenna. These modifications are discussed in detail. Because it was desired to have data recorded in an automatic fashion, an automated data recording system was developed. The report presents the design, construction, and testing of the automatic recording system which will ultimately be used with a digital recording system now under construction. All circuit diagrams are included along with any other information which may be helpful in equipment operation and repair. A brief description of some of the recorded data is presented in the final chapter. (Author Modified Abstract) GRA

N73-26429# Army Foreign Science and Technology Center, Charlottesville, Va.
AEROSOL MODEL OF THE ATMOSPHERE
L. S. Ivlev 13 Mar. 1973 45 p refs Transl. into ENGLISH from Probl. Fiz. Atmos. (Leningrad), no. 7 p 125-160
(AD-760393; FSTC-HT-23-474-72) Avail: NTIS CSCL 04/1

An attempt is made to construct an aerosol model based on the available experimental data regarding the vertical profile of aerosol attenuation, particle number concentration and size distribution at various heights, as well as indirect data regarding the ion content and electric conductivity of the air, using simple theoretical calculations and certain assumptions about distribution mechanism and sources of the atmospheric aerosol. For this purpose two questions must be considered: (1) sources of the aerosol and processes regulating its distribution in the atmosphere; and (2) an analysis of the results of the experimental data obtained by various investigators. (Author Modified Abstract) GRA

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-26430* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TEMPERATURE CONTROL SYSTEM WITH A PULSE WIDTH MODULATED BRIDGE Patent
Richard C. Heyser, inventor (to NASA) Issued 15 May 1973 5 p Filed 24 Dec. 1970 Supersedes N71-33106 (09 - 20, p 3272)
(NASA-Case-NPO-11304; US-Patent-3,733,463;
US-Patent-Appl-SN-101214; US-Patent-Class-219-499;
US-Patent-Class-219-50) Avail: US Patent Office CSCL 14B

A temperature control system, which includes a modified wheatstone bridge with a resistive-capacitive (RC) circuit in one leg of the bridge, is disclosed. The RC circuit includes a resistor which provides an effective resistance as a function of its absolute resistance and the on-time to off-time ratio of pulses supplied to a switch connected across it. A sawtooth voltage is produced across the RC circuit. The voltage is compared with the voltage across a temperature sensor with heat being applied during each pulse period portion when the sawtooth voltage exceeds the voltage across the temperature sensor.
Official Gazette of the U.S. Patent Office

N73-26431* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ON-FILM OPTICAL RECORDING OF CAMERA LENS SETTINGS Patent
Richard E. Thompson, inventor (to NASA) Issued 5 Jun. 1973 6 p Filed 17 Mar. 1971 Supersedes N72-11373 (10 - 02, p 0198)
(NASA-Case-MSC-12363-1; US-Patent-3,736,849;
US-Patent-Appl-SN-125236; US-Patent-Class-95-1.1) Avail: US Patent Office CSCL 14E

An apparatus is described for recording a representation of the camera lens aperture and focus setting on the film of a camera, while the photographic image is being recorded. A data lens is provided between the camera lens and film, by means of which the aperture and focus setting may be determined. The determination is made by measuring both the location and the size of a data image provided by the data lens. The data lens apparatus requires no electrical power, is low in weight, and does not result in an increase in the external dimensions of the camera. Official Gazette of the U.S. Patent Office

N73-26432* National Aeronautics and Space Administration, Washington, D.C.
METHOD AND APPARATUS FOR MEASURING SOLAR ACTIVITY AND ATMOSPHERIC RADIATION EFFECTS Patent
George C. Haroules and Wilfred E. Brown, inventors (to NASA) Issued 5 Jun. 1973 8 p Filed 31 Mar. 1970 Supersedes N70-26820 (08 - 13, p 2383)
(NASA-Case-ERC-10276; US-Patent-3,737,905; US-Patent-Appl-SN-24155; US-Patent-Class-343-100ME; US-Patent-Class-340-15.5GC; US-Patent-Class-250-209) Avail: US Patent Office CSCL 09E

A radiometric measuring system is described for observing solar activity, atmospheric attenuation, and atmospheric emission. Two highly directional microwave antennas are mounted side by-side on an equatorial mount which tracks the sun. One antenna is aimed directly at the sun to provide a sun temperature, and the other antenna is aimed at a slight angle to the sun antenna to provide a sky temperature reference. Signals from the two antennas are compared in a radiometric detecting system and provide information concerning solar activity and atmospheric attenuation and emission.
Official Gazette of the U.S. Patent Office

N73-26433 Kansas Univ., Lawrence.
AN AUTOMATED IMAGE PROCESSING SYSTEM, IDECS Ph.D. Thesis
Philip Norman Anderson 1972 733 p
Avail: Univ. Microfilms Order No. 72-32859

The IDECS (Image Discrimination, Enhancement, and Combination System) is an analog-digital near real-time image processing system. The redesign of the IDECS system to include an interface to a PDP 15/20 computer and a central processor for the IDECS itself is described along with the redesign of the enhancement circuits and image flying spot scanners to take advantage of the latest integrated circuit technologies. The resulting IDECS is a hybrid combining the advantages of high speed analog processing with the flexibility of digital processing and digital control of the analog processing Dissert. Abstr.

N73-26434 Wisconsin Univ., Madison.
A SONIC VELOMETER Ph.D. Thesis
John Howard Stichman 1972 156 p
Avail: Univ. Microfilms Order No. 72-23765

A sonic velometer using the transit times of ultrasonic pulses in air to measure the air velocity was developed. For each vector component of the wind to be measured, there are two sets of ultrasonic transducers placed in juxtaposition such that one set of transmitters and receivers transmits sound in one direction while the other set transmits in the opposite direction over the same distance. Feedback control techniques are used so that for each transducer pair, the transmitter emits a pulse as soon as the receiver has received the preceding pulses. An output proportional to the wind velocity component along the axis of these transducer pairs is obtained by forming the difference of the pulse repetition frequencies of the two channels. A coarse loop brings the transmitted and received pulse trains near synchronism, and then a sinusoidal parameter perturbation is applied to determine accurately the time of pulse arrival. The velometer has a velocity resolution capability of 0.5 m/s and a dynamic range of 50 m/s. Dissert. Abstr.

N73-26435 Newark Coll. of Engineering, N.J.
METHODS FOR ACOUSTIC HOLOGRAPHY AND ACOUSTIC MEASUREMENTS Ph.D. Thesis
Wolfgang Klaus Fischer 1972 249 p
Avail: Univ. Microfilms Order No. 72-26333

A four-step acoustical holographic imaging system is described, and several means for its implementation are analyzed both theoretically and experimentally. This system is compared with other methods of acoustical holography, (i.e., permitting to obtain a visible, 3-D image of an object insonified with supersonic waves), and some of its advantages are indicated. The use of optical holographic techniques to convert an arbitrary acoustic image to a visible image is investigated. The holographic sound image converter is introduced and analyzed. This converter consists of the holographic interferometer and an appropriate coupler. Unlike present acoustic detectors, it exhibits the ability to simultaneously detect a quantity related to the vibration amplitude at each point of the acoustical diffraction pattern.
Dissert. Abstr.

N73-26436 Utah State Univ., Logan.
PREDICTION AND MEASUREMENT OF EXHAUST PLUME ELECTRICAL PROPERTIES Ph.D. Thesis
Charles Harry Wright 1972 133 p
Avail: Univ. Microfilms Order No. 73-927

A three-coil plasma probe was used to measure the electrical conductivity and velocity in the exhaust from a solid propellant rocket. A Langmuir probe was used to measure the electron temperature and electron density in the same exhaust plume. The measurements were made at 10 and at 33 exit diameters downstream from the nozzle exit and defined a profile across the plume at these stations. A thermochemical calculation was made for the combustion and nozzle expansion. The exhaust plume was predicted by a plume mixing program, allowing secondary combustion with the air, and by a method of characteristics plume program, continuing through an empirical subsonic plume program. Comparisons are made between the measured and predicted data. Dissert. Abstr.

N73-26437*# Stanford Univ., Calif. Remote Sensing Lab.
FIELD STUDIES IN SUPPORT OF NIMBUS-E SURFACE COMPOSITION MAPPING RADIOMETER
R. J. P. Lyon and A. A. Green 25 May 1973 99 p refs
(Contract NAS5-21733)
(NASA-CR-132764; SU-RSL-TR-73-1) Avail: NTIS HC $7.00 CSCL 14B

If the outputs of the two channels are spacially registered and combined to generate a third variable which reflects the differences between the two outputs, then this variable can then be redisplayed in image form and its magnitude should be relatable to the silica content of the rocks imaged. Two methods were proposed for generating this third variable, the first is to take the difference in apparent temperature between the two channels and the second is to ratio the voltage outputs of the two channels. The responses of the two channel high resolution surface composition mapping radiometer and the thermal channels of the MSDS scanner were calculated from data recorded with the NASA IR pallet and simulate the output of these systems had they been flying over the same targets as the IR pallet. Author

N73-26438*# Texas A&M Univ., College Station. Remote Sensing Center.
REMOTE MONITORING OF SOIL MOISTURE USING AIRBORNE MICROWAVE RADIOMETERS
C. L. Kroll Jun. 1973 137 p refs
(Contract NAS9-11155; Grant NGL-44-001-001)
(NASA-CR-133102; RSC-43) Avail: NTIS HC $9.00 CSCL 14B

The current status of microwave radiometry is provided. The fundamentals of the microwave radiometer are reviewed with particular reference to airborne operations, and the interpretative procedures normally used for the modeling of the apparent temperature are presented. Airborne microwave radiometer measurements were made over selected flight lines in Chickasha, Oklahoma and Weslaco, Texas. Extensive ground measurements of soil moisture were made in support of the aircraft mission over the two locations. In addition, laboratory determination of the complex permittivities of soil samples taken from the flight lines were made with varying moisture contents. The data were analyzed to determine the degree of correlation between measured apparent temperatures and soil moisture content. Author

N73-26439# Porto Univ. (Portugal).
FUNDAMENTAL PROBLEMS OF PHOTOELECTRIC PHOTOMETRY [PROBLEMAS FUNDAMENTAIS DE FOTOMETRIA FOTOELECTRICA]
Antonio J. Pascoal 1971 49 p refs In PORTUGUESE
(Publ-4) Avail: NTIS HC $4.50

The use of the 76 cm Cassegrain reflector in photoelectric photometry is discussed, and the scheme is presented of the photoelectric photometer. Photoelectric detectors, the precision, high voltage requirements, amplification and registers are discussed along with observation procedures, calibration, and data

reduction for the system. A computer program for processing observations is included. Transl. by F.O.S.

N73-26440# Osservatorio Astronomico, Roma (Italy).
USE OF A TELECAMERA AS A CONTRAST MONITOR [USO DI UNA TELECAMERA COME MONITOR DI CONTRASTO]
Vincenzo Croce, G. A. DeBiase, F. Fabbri, and M. Ferrari Toniolo Oct. 1972 7 p refs In ITALIAN
(RR-1) Avail: NTIS HC $3.00

An automatic system is described for aiding photographic surveys of the solar photospheric granulation which significantly influence the conditions for viewing. The emitted signals from a telecamera, and characteristics of a suitable optical system are analyzed in real time. From this analysis, information is obtained on image contrast for the optimum conditions for photographic registration. Transl. by F.O.S.

N73-26441# Osservatorio Astronomico, Roma (Italy).
AN OPTICAL APPARATUS FOR STUDYING THE PHOTOSPHERE: A STUDY OF SOME EFFICIENCY ASPECTS [UN APPARATO OTTICO PER LO STUDIO DELLA FOTOSFERA. ESAME DI ALCUNI ELEMENTI RELATIVIAL RENDIMENTO]
Vincenzo Croce Dec. 1972 14 p refs In ITALIAN
(RR-4) Avail: NTIS HC $3.00

The photometric profile is examined of the solar limb obtained by an optical device for photographic registration of the photosphere. The influence of contrast loss on the details of various factors, the diffuse light and resolution potential are analyzed, and a comparison is presented of results obtained with and without aperture reduction in the optical system. Transl. by F.O.S.

N73-26442*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTROSTATIC ENTRAINED MATERIAL MEASUREMENT SYSTEM Patent Application
James E. Johnston, inventor (to NASA) Filed 5 Jun. 1973 10 p
(NASA-Case-MFS-22128-1; US-Patent-Appl-SN-367292) Avail: NTIS HC $3.00 CSCL 14B

A method for measuring the quantity of particulate matter suspended in air or other gas is described for use in evaluating air pollution. Air is drawn through a conduit by a vacuum source at a substantially constant rate. The conduit may be metal or plastic. An electrostatic charge proportional to the amount of particulate matter in the air is induced on the conduit by the current flow. The value of the induced charge is monitored by an electrostatic sensor and displayed. The system is designed to be compact and battery operated, with the conduit and sensing unit as a mobile probe. It may be used in clean rooms, special material processing facilities, and areas presenting dust hazard (health or explosive). NASA

N73-26443*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A TECHNIQUE FOR MEASURING HYPERSONIC FLOW VELOCITY PROFILES
Luther R. Gartrell Washington Jul. 1973 40 p refs
(NASA-TN-D-7270) Avail: NTIS HC $3.00 CSCL 14B

A technique for measuring hypersonic flow velocity profiles is described. This technique utilizes an arc-discharge-electron-beam system to produce a luminous disturbance in the flow. The time of flight of this disturbance was measured. Experimental tests were conducted in the Langley pilot model expansion tube. The measured velocities were of the order of 6000 m/sec over a free-stream density range from 0.000196 to 0.00186 kg/cu m. The fractional error in the velocity measurements was less than 5 percent. Long arc discharge columns (0.356 m) were generated under hypersonic flow conditions in the expansion-tube modified to operate as an expansion tunnel. Author

N73-26444*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF SOIL MOISTURE WITH MICROWAVE RADIOMETER
T. Schmugge, P. Gloersen, and T. Wilheit Aug. 1973 38 p refs Submitted for publication
(NASA-TM-X-66265; X-652-72-305) Avail: NTIS CSCL 14B

The use of microwave radiometry for the remote sensing of soil moisture has been studied in a series of aircraft flights over agricultural test areas in the southwestern U.S. The radiometers covered the wavelength range 0.8 cm to 21 cm. Ground truth in the form of gravimetric soil moisture measurements were obtained at each test site. The results indicate that it is possible to monitor soil moisture variations with airborne radiometers. The emission in general, is not a linear function of soil moisture and is affected by soil type and surface conditions such as roughness and vegetative cover. Author

N73-26445# Aeronautical Research Labs., Melbourne (Australia).
SOME ASPECTS OF IMAGE INTENSIFICATION IN FIELD ION MICROSCOPY
W. J. Pollock Oct. 1972 26 p refs
(ARL/Inst-Note-78) Avail: NTIS HC $3.50

Design details are presented for a demountable, nonbakeable field ion microscope. Descriptions are also given for an automatic liquid nitrogen level control and pulsed field evaporation source which are utilized with the microscope. Three methods of image intensification are studied to determine the optimum conditions for viewing the field ion image. Author

N73-26446*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
GATED HIGH SPEED OPTICAL DETECTOR Final Report, Jan. 1972 - Jan. 1973
S. I. Green, L. M. Carson, and G. W. Neal Jan. 1973 73 p
(Contract NAS5-11471)
(NASA-CR-132772) Avail: NTIS HC $5.75 CSCL 20F

The design, fabrication, and test of two gated, high speed optical detectors for use in high speed digital laser communication links are discussed. The optical detectors used a dynamic crossed field photomultiplier and electronics including dc bias and RF drive circuits, automatic remote synchronization circuits, automatic gain control circuits, and threshold detection circuits. The equipment is used to detect binary encoded signals from a mode locked neodynium laser. Author

N73-26447*# Kanner (Leo) Associates, Redwood City, Calif.
POSSIBILITIES OF STUDYING AND MAPPING SOIL COVER ON THE BASIS OF SPACE PHOTOGRAPHY
V. I. Kravtzova Washington NASA Jun. 1973 21 p refs Transl. into ENGLISH from "Vozmozhnosti Izucheniya i Kartografirovaniya Pochvennogo Pokrova po Kosmicheskim Snimkam" Moscow Presented at the meeting of the Soviet-American Working Group on Remote Sensing of Natural Environment from Space, 12-17 Feb. 1973
(Contract NASw-2481)
(NASA-TT-F-14971) Avail: NTIS HC $3.25 CSCL 08B

The use of photographs taken from spacecraft and artificial satellites in the study of soil cover in various territories is discussed. Differences in soil conditions are reflected in the photographs in terms of brightness of tone, using such indications as the state of the crops, natural vegetation, natural topography, etc. In many cases the photographs detect differences in soil conditions and details that cannot be determined from topographic and large-scale soil maps, and only with difficulty from aerial photographs. Examples are changes in the mechanical composition of soils, wind, and water erosion. Hence space photographs can be used advantageously in soil cartography. It was concluded that space photographs are a valuable tool in the study of the structure of soil systems, the detection of complex soils, and combinations of various types of soils that are characteristic of different natural conditions. Author

N73-26448*# IIT Research Inst., Chicago, Ill.
CONTINUED DEVELOPMENT OF THE COMBINED PULSED NEUTRON EXPERIMENT (CPNE) FOR LUNAR AND PLANETARY SURFACES Final Report, 15 Jun. 1971 - 23 Sep. 1972
J. W. Mandler 1 Feb. 1973 71 p refs
(Contract NASw-2258)
(NASA-CR-132208; IITRI-V6121-2) Avail: NTIS HC $5.75 CSCL 14B

Current progress is reported on the inelastic scattering,

capture, and activation gamma ray portions of the Combined Pulsed Neutron Experiment (CPNE). Experiments are described which have enabled a reduction in weight of the experimental probe to 7.3 kg. Parametric studies are described which enabled the optimization of experimental parameters (e.g., gate time settings, neutron pulse rate, etc.). Estimated detection sensitivities using this light weight probe and the optimized experimental parameters are discussed. Author

N73-26449*# Alabama Univ., University. Bureau of Engineering Research.
ACTIVE CONTROL OF PRIMARY MIRROR OF AN ORBITING TELESCOPE WITH THERMAL EXCITATION Interim Report
James L. Hill and John N. Youngblood May 1973 96 p refs
(Contract NAS8-28019)
(NASA-CR-124286; BER-153-09) Avail: NTIS HC $7.00 CSCL 17H

The results of a study of the feasibility of an active method of surface error control using thermal elements are presented. It is shown that the control effort of the thermal elements is sufficient for the purpose, and that such benefits as low cost, low weight, and high reliability may be achieved in conjunction with a significant reduction in the mirror surface error figure. Author

N73-26450*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
ELECTRON-PROTON SPECTROMETER (EPS) COMPONENT DERATING SUMMARY
P. Gleeson Sep. 1972 89 p refs
(Contract NAS9-11373)
(NASA-CR-128706; LEC/EPS-878) Avail: NTIS HC $6.50 CSCL 14B

The derating factors are defined, and all components used in the electron-proton spectrometer to determine effective system performance are analyzed. Basic information is presented for defining the rating of electrical and electronic components. The derating percentages and application rates assist in obtaining reliable operation of component parts used in manned space mission requirements. Author

N73-26451*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
TEST REPORT: ELECTRON-PROTON SPECTROMETER ENGINEERING TEST UNIT
D. L. Vincent Jan. 1972 69 p
(Contract NAS9-11373)
(NASA-CR-128701; LEC/EPS-521) Avail: NTIS HC $5.50 CSCL 14B

The engineering test unit of the electron-proton spectrometer was thermal/vacuum tested. The tests confirmed the thermal analysis, and verified that the thermal design would control the temperatures of the instrument. Author

N73-26452# United Kingdom Atomic Energy Authority, Harwell (England).
SIMPLE BEAM POSITION MONITOR USING Y.S.I. PRECISION THERMISTORS
B. P. Clear Dec. 1972 12 p refs
(AERE-M-2372) Avail: AEC Depository Libraries, HMSO 50 p; PHI $2.15

A beam position monitor is described which operates by the detection of temperature differences between opposite ends of the horizontal and vertical diameters of the thin metal window through which the beam passes. Thermistors may be used for this purpose in a Wheatstone bridge network provided they remain accurately matched over the required temperature range. It was found that thermistors manufactured by the Y.S.I. Company (U.S.A.) were satisfactory for this purpose, and enabled a simple monitor to be constructed with a high position sensitivity, eliminating the need for preamplifiers. Author (NSA)

N73-26453# California Univ., Livermore. Lawrence Livermore Lab.
LLL ELECTRON AND PROTON SPECTROMETER ON NASA'S ORBITING GEOPHYSICAL OBSERVATORY V(E): THE THREE WAY MERGED TAPE (AN ARCHIVAL DATA BASE)
M. M. Zeligman and J. R. Walton 7 Dec. 1972 187 p refs
(Contract W-7405-eng-48)
(UCRL-51314) Avail: NTIS

This is a description of a data base that can be used for archival records. The data are combined from three sources and thus the name of the resultant tape: The Three-Way Merged Tape. The data contained on these tapes came from the following sources the LLL Electron and Proton Spectrometer (Experiment E-06 on NASA's Orbiting Geophysical Observatory V(E), attitude-orbit tapes containing the satellite ephemeris provided by Goddard Space Flight Center, and magnetometer tapes provided with data from the Triaxial Fluxgate Magnetometer Experiment (Experiment E-14) on OGO-5. Author (NSA)

N73-26454# Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.
ASTRONOMICAL EXPERIMENT ONBOARD SKYLAB MANNED ORBITAL SPACE STATION: ATLAS S183 [EXPERIENCE ASTRONOMIQUE EMBARQUEE SUR LA STATION ORBITALE HABITEE SKYLAB. ATLAS S183]
Alain Magnan Apr. 1972 40 p In FRENCH
Avail: NTIS HC $4.00

The S183 experiment onboard the Skylab orbital space station is described, including principles of experiment, storage space in Skylab, description of the experimental design with mechanical and electrical interfaces, and operations during the orbital phase. The aim of the S183 experiment is to study the hot star distribution in the sky and, particularly, in the Milky Way. The wideband spectrophotometer, able to measure the color indices of hot stars and stellar objects, will furnish a detailed classification of stars and, therefore, a basis for comparison with previous mathematical models. ESRO

N73-26455# Rome Univ. (Italy). Inst. of Physics.
USE OF FLEXIBLE PLASTIC TUBES FOR AUTOMATIC RECORDING OF PARTICLE TRACKS
M. Conversi 12 Dec. 1972 11 p refs Submitted for publication
(Nota-Interna-416) Avail: NTIS HC $3.00

Flexible tubes of thin plastic material with a flowing mixture of noble gases are the basic elements of a new type of versatile electrically pulsed track chamber, potentially useful for nuclear and high energy experimental physics. Information can be extracted from the chamber elements through either electric or optical signals elaborated by vidicon-type systems. The new detector is characterized by great flexibility, good over-all space-time resolution, recovery time of about 10 milliseconds, and very low cost of construction and operation. It is particularly suitable for experiments with particle accelerators aiming at a 4 pi geometry and for cosmic ray experiments requiring large collecting areas. Author (ESRO)

N73-26456# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
AN ELECTRON-OPTICAL SHUTTER FOR SHUTTER OPENING TIMES OF 0.05 NANOSEC [EIN ELEKTRONENOPTISCHER VERSCHLUSS FUER OEFFNUNGSZEITEN VON 0.05 NANOSEC]
H. Strohwald May 1972 64 p refs In GERMAN
(IPF-72-5) Avail: NTIS HC $5.25

An investigation of optoelectronic shutters for image converters with opening times of 0.05 nsec was carried out. The conditions for light source and test equipment necessary to obtain shutter times of smaller than 1 nsec are reviewed. The limitations of the shortest opening times for several image converter types are indicated. Based on the reasons for these limitations, an optoelectronic shutter was developed. The shortest opening time of 0.05 nsec expected from approximation calculations was confirmed from measurements of the switching pulses on the shutter element. ESRO

N73-26457# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
TRANSIENT BEHAVIOR AND SENSITIVITY STUDY OF AN OPTICAL INFRARED IMAGE CONVERTER [UNTERSUCHUNGEN UEBER DAS ZEITLICHE VERHALTEN UND DIE EMPFINDLICHKEIT EINES OPTISCHEN INFRAROT-BILDWANDLERS]
V. Dieterle Jun. 1972 74 p refs In GERMAN

(IPF-72-6) Avail: NTIS HC $5.75

An optical infrared image converter was investigated. The physical effect used for image conversion, is based on the variation of reflected light energy near total reflection, when light incides on the boundary layer of two media with different refractivities, one of which is varied by radiation. The reflected light energy near the boundary layer depends not only upon the angle of incidence, but also on the ratio of the refractivities (Fresnel formulas). The optically thinner medium is a fluid, as its refractivity is easily influenced by temperature. The optical resolving power, the sensitivity, and especially the transient response of this type of infrared converter were examined.
ESRO

N73-26458# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

A NEW PHOTOGRAMMETRIC PLOTTING SYSTEM

Otto Hofmann 4 Jul. 1972 33 p Presented at the 12th Intern. Congr. on Photogrammetry, Ottawa, Jul. - Aug. 1972
(MBB-UR-150-72-O) Avail: NTIS HC $3.75

A new photogrammetric plotting system for graphical and digital plotting of stereoparsi is described. A single basic unit in conjunction with a number of accessories will cover the entire range of stereophotogrammetric plotting encountered in practical work. The modular construction of this equipment permits digital and graphical plotting a satellite pictures, air photos and terrestrial photography up to 9 in. x 9 in. and taken with focal lengths in the range from 50 mm to 3276 mm. Author (ESRO)

N73-26459# Stockholm Univ. (Sweden). Inst. of Meteorology.

HIGH INTENSITY ATOMIC EMISSION LINE SOURCES IN THE VACUUM ULTRAVIOLET REGION

Tage Severholt and Georg Witt Jan. 1972 25 p refs
(Contract SWEDBTD-71-348-U-253)
(AP-11) Avail: NTIS HC $3.25

A versatile atomic resonance line lamp of low pressure and high spectral purity was constructed. The lamp can be used for photochemical work in the vacuum ultraviolet region down to 1050 A either using gas flow or steady state conditions. Atomic resonance lines of He, Ne, Ar, Kr, Xe and H, N, O (both 3P and 1D) were produced by a stabilized microwave power operated at 2450 MHz. Preliminary actinometric measurements indicate an emission rate greater than 10 to the 15 power quanta/sec by Kr (1236) at 40 W microwave input. The design, construction and operation of the atomic line source is described. The theory of atomic resonance lines, their intensity relation and use surveyed and discussed. Author (ESRO)

N73-26460# Uppsala Univ. (Sweden). Inst. of Physics.

PERSPECTIVES AND PROBLEMS IN ELECTRON SPECTROSCOPY

Kai Siegbahn Oct. 1971 66 p Presented at the Intern. Conf. on Electron Spectroscopy, Asilomar, Calif., 7-10 Sep. 1971
(UUIP-752) Avail: NTIS HC $5.50

The future of electron spectroscopy is considered commencing with a review of electron spectra excitation, line widths and resolution. Experimental approaches to increase instrument resolving power and improve techniques are described. Ultra soft X-ray emission from free molecules as a complement to electron spectroscopy of molecular levels is discussed as well as the relation of electron spectroscopy to quantum chemistry. Finally fields of research in electron spectroscopy are examined.
ESRO

N73-26461# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).

DEVICE FOR MEASURING VIBRATIONS, SURFACE DEFECTS, AND DISTANCE TO SURFACE OF FLOATING HEADS FOR MASS MEMORY MAGNETIC DISKS Final Report [ETUDE D'UN APPAREIL PERMETTANT DE MESURER LES VIBRATIONS, LES DEFAUTS DE SURFACE ET LA HATEUR DE VOL DES TETES FLOTTANTES DES DISQUES DES MEMOIRES DE MASSE MAGNETIQUES]

M. Chartier 30 Nov. 1971 51 p refs In FRENCH
(Contract DegInf-70 80.082)
(LCR-71-216/1/R) Avail: NTIS HC $4.75

The development of lasers, sources of coherent electromagnetic radiation, allows the application of interferometric techniques to the determination of motion characteristics of a mobile mechanical system. The analysis of reflected rays identified the displacement of a point with a half wavelength resolution. This resolution can be improved to lamda/4N by subdividing the interference signal in N signals having a pi/N phase shift. The operational and theoretical characteristics of the experimental equipment making use of a Michelson interferometer with a Ne-He laser source are presented and described, including signal processing and the optical receiving system. This measuring equipment is suitable for the measurement of distance to surface of floating heads for mass memory and also to measurement of magnetic disk vibrations.
ESRO

N73-26462# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

AN APPARATUS FOR MEASURING THERMAL CONDUCTIVITIES TO 2 DEGREES K. MEASUREMENTS IN SINGLE CRYSTAL HALIDES AS A FUNCTION OF DISLOCATION DENSITY Technical Report, Nov. 1968 - Mar. 1971

George L. Haury Dec. 1972 39 p refs
(AF Proj. 7360)
(AD-759552; AFML-TR-72-252) Avail: NTIS CSCL 14/2

A thermal conductivity apparatus was constructed and used to measure the thermal conductivity of a single crystal of sodium chloride as a function of dislocation density, N. The temperature range of the measurements was 2.5 to 40K. The temperatures were measured with gold (.02 atomic % iron) vs. chromel thermocouples, and germanium resistance thermometers. A well defined maximum was observed in the thermal conductivity at around 10K, the value of which was three times greater in an annealed crystal (minimum number of dislocations) than it was in the unannealed crystal. A relationship of K = 0.049(T to the 2.7 power)/(N to the 0.8 power) was observed between T equal to 7 and 2K for the thermal conductivity vs. temperature.
Author (GRA)

N73-26463# Stanford Univ., Calif. Dept. of Computer Science.

COMPUTER IDENTIFICATION OF TEXTURED VISUAL SCENES

Ruzena Bajcsy Oct. 1972 167 p refs
(Contract ARPA SD-183; ARPA Order 457)
(AD-759712; STAN-CS-72-321; AIMI-180) Avail: NTIS CSCL 14/5

The work deals with computer analysis of textured outdoor scenes involving grass, trees, water and clouds. Descriptions of texture are formalized from natural language descriptions; local descriptors are obtained from the directional and nondirectional components of the Fourier transform power spectrum. Analytic expressions are obtained for orientation, contrast, size, spacing, and in periodic cases, the locations of the choice of sizes is made by a simple higher-level program. The process of region growing is represented by a sheaf-theoretical model which formalizes the operation of pasting local structure (over a window) into global structure (over a region). Programs were implemented which form regions of similar color and similar texture with respect to the local descriptors. (Author Modified Abstract) GRA

N73-26464# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

VIBRATION METHOD OF MEASURING VISCOSITY OF LIQUIDS

A. N. Solovev, A. B. Kaplun, and S. S. Kutateladze 4 Apr. 1973 156 p refs Transl. into ENGLISH of the book "Vibratsionnyi Metod Izmereniya Vyazkosti Zhidkostei" 1970 p 1-140
(AF Proj. 7343)
(AD-759389; FTD-HC-23-851-72) Avail: NTIS CSCL 14/2

Contents: Theory of the vibration method; Experimental verification of the theory of the vibration method; The sensor and the electronic circuit of the viscosimeter; Vibration viscosimeters; Investigation of the viscosity of liquids. GRA

N73-26465# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.

LASER RAMAN PROBE FOR FLAME TEMPERATURE

Marshall Lapp (Gen. Elec. Co., Schenectady, N. Y.), Carl M. Penney (Gen. Elec. Co., Schenectady, N. Y.), and Richard L. St.Peters (Gen. Elec. Co., Schenectady, N. Y.) Apr. 1973 54 p refs

(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. SQUID)
(AD-759386; SQUID-TR-GE-1-PU) Avail: NTIS CSCL 14/2

Experimental spectra of Raman Scattering Stokes fundamental vibrational Q-branches for nitrogen and hydrogen in hydrogen-air flames have been fit to theoretically-calculated profiles in order to determine temperature. The temperature measured from a least square fit of the full nitrogen profile agreed to within about 1/2% of the value calculated from the ratio of the peak intensity of the first upper state band (i.e., hot band) to that of the ground state band. Agreement with the temperature estimated from fine-wire thermocouple measurements was approximately 2%. Additional theoretical profile calculations are given from nitrogen and hydrogen over the wide range of temperatures. Author (GRA)

N73-26466# Princeton Univ., N.J. Dept. of Chemistry.
A NEW ZERO-FIELD PARAMAGNETIC RESONANCE SPECTROMETER Technical Report, 28 Feb. 1972 - 1 Mar. 1973
Elliot. R. Berstein and Gregg M. Dobbs 2 Apr. 1973 36 p refs
(Contract N00014-67-A-0151-0032; NR Proj. 056-528)
(AD-759370) Avail: NTIS CSCL 14/2

The construction of a new zero-field paramagnetic resonance (ZFPMR) spectrometer is discussed. Spectrometer organization and construction details are presented for both resonant cavities and broadband traveling-wave helices as sample holders. A new circuit diagram for a square wave magnetic field modulator with fast time is given. The performance of each kind of spectrometer is discussed with particular emphasis on investigation of paramagnetic rare earth ions with zero-field splittings in diamagnetic host lattices. Author (GRA)

N73-26467# IIT Research Inst., Chicago, Ill.
TRANSMISSOMETER DEVELOPMENT FOR JET ENGINE EXHAUST PLUMES Final Report, 1 Jul. 1972 - 2 Mar. 1973
H. T. Betz May 1973 39 p refs
(Contract N00140-72-C-6901)
(AD-760050) Avail: NTIS CSCL 20/6

The report describes an instrument constructed to measure the transmission of aircraft jet engine exhausts. This instrument was designed and built as an experimental breadboard system to explore the requirements and possibilities of a transmissometer in evaluating the measurement of optical transmission through an exhaust plume for characterizing the exhaust parameters. It is designed as an advanced breadboard so that all optical functions remain flexible permitting modification as experience indicates change. GRA

N73-26468# Woods Hole Oceanographic Institution, Mass.
A SELF-CONTAINED DIGITAL INTEGRATOR FOR REMOTE LOCATION
Richard E. Payne and Paul C. Murray Feb. 1973 19 p
(Contract N00014-66-C-0241)
(AD-760318; WHOI-73-9) Avail: NTIS CSCL 14/2

A need developed for accurate recording of total daily solar irradiance at remote locations. Heretofore, stripchart recordings of solar flux made at accessible locations were subsequently integrated graphically to render total irradiance. Ultimate accuracy was limited by recorder accuracy and the human error introduced during integration. This report describes a digital integrator which accepts the analogue output of a pyranometer and delivers output current to drive a stripchart recorder pen. Recording and integration errors are greatly reduced. Moreover, power consumption is low enough to make several months unattended recording of a pyranometer or other device a practical consideration. Author (GRA)

N73-26469# General Electric Co., Wilmington, Mass. Aerospace Instruments and Control Systems Dept.
SOLID STATE VERTICAL SCALE AIRCRAFT ENGINE PERFORMANCE INDICATOR SET Final Report, Apr. 1971 - Apr. 1973
Richard L. Skovholt, George H. Cawood, Robert E. Glusick, Norval P. Miller, and Wallace W. Thurlov Apr. 1973 93 p refs
(Contract N62269-71-C-0392)
(AD-760351; DF73AEE160) Avail: NTIS CSCL 01/4

The report is the Final Technical Report for Contract No. N62269-71-C-0392 entitled Solid State Vertical Scale Aircraft Engine Performance Indicator Set. A program is reported which involves the design, fabrication and testing of two sets of solid state engine instruments. Each set consists of three instruments which display two channels of Exhaust Gas Temperature (EGT), Percent of Engine Fan Speed (RPM) and Rate of Fuel Flow (FF). This equipment receives the appropriate sensor information from the actual sensors and transmitters for the A6A aircraft. The display media is gallium arsenide phosphide LED'S emitting a red colored light. The display presentation gives bar graph and numerical readout information. Special techniques were utilized in the fabrication of the scale plates in order to obtain sufficient contrast enhancement. (Author Modified Abstract) GRA

N73-26470# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ASPIRATION OF AEROSOL SAMPLES FROM A FLOW BY ZERO SAMPLING TUBE
S. P. Belyavev 6 Apr. 1973 17 p refs Transl. into ENGLISH from Fiz. Aerosoley. Eksperim i Pribory (USSR), no. 7, 1967 p 74-82
(AD-759868; FTD-HT-23-161-73) Avail: NTIS CSCL 14/2

Results are given for a study on one type of zero aerosol sampling tube. Conditions are indicated under which the isokinetic coefficient changes very little with a change in the velocity of the impinging flow. The need to introduce a new correction coefficient which will consider the shape of the tube is explained. A method is proposed for calibrating zero sampling tubes. Formulas are recommended for selecting basic design parameters. (Author Modified Abstract) GRA

N73-26471# Picatinny Arsenal, Dover, N.J.
NEW PRODUCT REVIEW: TECHNICAL AND ECONOMIC ASPECTS OF NEW INDUSTRIAL RADIOGRAPHIC IMAGING PAPERS
Emmett G. Barnes and George Drucker Feb. 1973 13 p refs
(AD-759907; PA-TR-4474) Avail: NTIS CSCL 14/5

Recently introduced industrial radiographic imaging papers are described, and the results are reported of a limited evaluation of their performance. The manufacturers are not identified. The papers are of two types: One providing 10 second processing with a portable processor, but exhibiting gradual deterioration of image; the other provides permanent image retention, but requires conventional X-ray film processing methods. Both types of paper provide direct, negative images on a single emulsion, and are viewed under reflected light. Special fluorescent imaging screens are normally used with both papers. The papers were tested using a limited range of radiographic exposure techniques. Sensitivity and resolution of the papers did not equal that of conventional film, although, image quality was entirely satisfactory for many inspection applications. The principal advantage of these papers appears to be their low cost making them quite attractive for use in high production radiographic operations. (Author Modified Abstract) GRA

N73-26857 University Coll., London (England). Mullard Space Science Lab.
THE OAO-C X-RAY EXPERIMENT
P. W. Sanford *In* ESRO X-ray Astronomy in the Near Future Feb. 1973 p 19-23 (For availability see N73-26855 17-30)

N73-26859 Massachusetts Inst. of Tech., Cambridge.
DESCRIPTION AND PERFORMANCE OF THE THIRD SMALL ASTRONOMY SATELLITE (SAS-C)
William Mayer *In* ESRO X-ray Astronomy in the Near Future Feb. 1973 p 31-50 (For availability see N73-26855 17-30)

N73-26860 Utrecht State Univ. (Netherlands). Astronomical Inst.
X-RAY EXPERIMENT IN THE ASTRONOMICAL NETHERLANDS SATELLITE (ANS)
John Heise *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 51-59 (For availability see N73-26855 17-30)

N73-26862* Columbia Univ., New York. Columbia Astrophysics Lab.
STELLAR X-RAY POLARIMETRY ON OSO-1
P. B. Landecker and R. Novick *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 63-75 refs (For availability see N73-26855 17-30)
(Contract NAS5-11362; Grants NGR-33-008-102; NGR-33-008-125)
CSCL 03A

N73-26863* Columbia Univ., New York. Columbia Astrophysics Lab.
STELLAR BRAGG CRYSTAL X-RAY SPECTROMETRY ON OSO-1
P. B. Landecker and R. Novick *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 77-93 refs (For availability see N73-26855 17-30)
(Contract NAS5-11362; Grants NGR-33-008-102; NGR-33-008-125)
CSCL 03A

N73-26865 University Coll., London (England). Mullard Space Science Lab.
THE COSMIC X-RAY EXPERIMENTS SELECTED FOR OSO-J
J. L. Culhane *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 105-110 (For availability see N73-26855 17-30)

N73-26866 Naval Research Lab., Washington, D.C.
DESCRIPTION OF NRL HEAO-A EXPERIMENT
Seth D. Shulman *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 111-114 (For availability see N73-26855 17-30)

N73-26867 Massachusetts Inst. of Tech., Cambridge.
INTEGRATED MODULATION COLLIMATOR EXPERIMENT ON HEAO-A FOR OBSERVATION OF X-RAY SOURCES IN THE ENERGY RANGE 1-15 keV
Gianfranco Spada *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 115-126 (For availability see N73-26855 17-30)

N73-26870* Columbia Univ., New York. Columbia Astrophysics Lab.
BRAGG CRYSTAL SPECTROMETER FOR HEAO-B X-RAY ASTRONOMY EXPERIMENT
J. R. P. Angel and B. E. Woodgate *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 155-162 refs (For availability see N73-26855 17-30)
(Contract NAS8-27405; Grant NGR-33-008-102)
CSCL 14B

N73-26871* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAO-B X-RAY EXPERIMENTS. NON-DISPERSIVE SPECTROSCOPY
E. A. Boldt *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 163-169 (For availability see N73-26855 17-30)
CSCL 03B

N73-26872 American Science and Engineering, Inc., Cambridge, Mass.
THE HEAO-C (LOXT) MISSION
Riccardo Giacconi *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 171-180 (For availability see N73-26855 17-30)

N73-26873 University Coll., London (England). Mullard Space Science Lab.
THE HEAO-C SOFT X-RAY TELESCOPE
P. W. Sanford *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 181-182 (For availability see N73-26855 17-30)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-26472* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
FLOATING BAFFLE TO IMPROVE EFFICIENCY OF LIQUID TRANSFER FROM TANKS Patent
Frank S. Howard, inventor (to NASA) Issued 5 Jun. 1973 5 p Filed 16 Sep. 1971 Supersedes N72-20467 (10 - 11, p 1482)
(NASA-Case-KSC-10639; US-Patent-3,736,956; US-Patent-Appl-SN-181023; US-Patent-Class-137-582; US-Patent-Class-137-397) Avail: US Patent Office CSCL 13I
A floating baffle is described which rides up and down on a vertical shaft over a drain in a tank as the liquid level within the tank varies. When the baffle is in the raised position, the liquid is allowed to flow out of the drain at an unrestricted rate. When the baffle is in the lowered position, pull-through of air or gas that is above the liquid is presented, which would interfere and reduce the flow of liquid from the tank.
Official Gazette of the U.S. Patent Office

N73-26473*# Environmental Research Inst. of Michigan, Ann Arbor.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Report, 1 May 1973
Richard F. Nelepka, Principal Investigator 13 Jun. 1973 1 p EREP
(Contract NAS9-13280)
(E73-10758; NASA-CR-133126; MR-3) Avail: NTIS HC $3.00 CSCL 05B
There are no author-identified significant results in this report.

N73-26474*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMBINED PRESSURE REGULATOR AND SHUTOFF VALVE Patent Application
Edgar F. Koch, inventor (to NASA) Filed 21 Jun. 1973 18 p
(Contract NAS7-100)
(NASA-Case-NPO-13201-1; US-Patent-Appl-SN-372149) Avail: NTIS HC $3.00 CSCL 13K
The development of a combined pressure regulator and shutoff valve is discussed. The components of the valve and the method of operation are described. Drawings of the equipment are provided. A feature of the valve is the pressure-response characteristics for the valve can be varied through a selective repositioning of a stop.
NASA

N73-26475*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TOOL FOR USE IN LIFTING PIN SUPPORTED OBJECTS Patent Application
Ronald A. Marzek and William S. Read, inventors (to NASA) Filed 18 Jun. 1973 15 p
(Contract NAS7-100)
(NASA-Case-NPO-13157-1; US-Patent-Appl-SN-370872) Avail: NTIS HC $3.00 CSCL 13I
A tool for lifting pin-supported electronic packages mounted in opposition to the surface of an electronic circuit board is described. The components of the device and the method of operation are explained. Diagrams of the mechanical linkages are included.
NASA

N73-26476*# Rocketdyne, Canoga Park, Calif.
LH2 AND LO2 TURBOPUMP ASSEMBLIES PROGRAM TEST PLAN AND FACILITIES REVIEW: MILESTONE REPORT
Charles D. Miller 1 Aug. 1972 19 p
(Contract NAS8-27794)
(NASA-CR-124194; ASR-72-195) Avail: NTIS HC $3.00 CSCL 13K
Revisions to the TPA test plan are presented. The revisions

include: revised LO2 TPA development test matrix, revised LH2 TPA development test matrix, and LO2 acceptance test matrix.
F.O.S.

N73-26477*# Hamilton Standard, Windsor Locks, Conn.
FAN AND PUMP NOISE CONTROL
John Misoda and Bernard Magliozzi May 1973 321 p refs (Contract NAS9-12457)
(NASA-CR-128986; SVHSER-6183) Avail: NTIS HC $18.25 CSCL 13K

The development is described of improved, low noise level fan and pump concepts for the space shuttle. In addition, a set of noise design criteria for small fans and pumps was derived. The concepts and criteria were created by obtaining Apollo hardware test data to correlate and modify existing noise estimating procedures. A set of space shuttle selection criteria was used to determine preliminary fan and pump concepts. These concepts were tested and modified to obtain noise sources and characteristics which yield the design criteria and quiet, efficient space shuttle fan and pump concepts. Author

N73-26478# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
PERFORMANCE FACTORS FOR CIRCULAR, HYDROSTATIC, GAS LUBRICATED THRUST BEARINGS. PART 3: RING THRUST BEARINGS
E. H. Dudgeon and M. C. Maki Mar. 1973 57 p refs
(NRC-13180PT-3; MT-65-Ot-3) Avail: NTIS HC $5.00

A general design procedure for ring type, hydrostatic, gas thrust bearings has been derived. Dimensionless load and flow factors have been calculated for a wide range of bearing parameters using a conformal transformation procedure proposed by Mori and Yabe. These factors are combined with empirical correlations for the bearing entry losses to provide a simple, convenient design procedure. The predicted performances are compared with a number of experimental studies. These results indicate the procedure is adequate for all normal design requirements. Author

N73-26479*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PARAMETRIC STUDY OF THE LUBRICATION OF THRUST LOADED 120-mm BORE BALL BEARINGS TO 3 MILLION DN
H. Signer, E. N. Bamberger, and E. V. Zaretsky 1973 33 p refs Proposed for presentation at Joint Lubrication Conf., Atlanta, 16-18 Oct. 1973; cosponsored by Am. Soc. of Lubrication Engr. and ASME
(NASA-TM-X-68264; E-7563) Avail: NTIS HC $3.75 CSCL 13I

A parametric study was performed with 120-mm bore angular-contact ball bearings under varying thrust loads, bearing and lubricant temperatures, and cooling and lubricant flow rates. Contact angles were nominally 20 and 24 deg with bearing speeds to 3 million DN. Endurance tests were run at 3 million DN and a temperature of 492 K (425 F) with 10 bearings having a nominal 24 deg contact angle at a thrust load of 22241 N (5000 lb). Bearing operating temperature, differences in temperatures between the inner and outer races, and bearing power consumption can be tuned to any desirable operating requirement by varying 4 parameters. These parameters are outer-race cooling, inner-race cooling, lubricant flow to the inner race, and oil inlet temperature. Preliminary endurance tests at 3 million DN and 492 K (425 F) indicate that long term bearing operation can be achieved with a high degree of reliability.
Author

N73-26480*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF 150-MILLIMETER BORE BALL BEARING TO 3 MILLION DN USING EITHER SOLID OR DRILLED BALLS
Herbert W. Scibbe and Harold E. Munson 1973 27 p refs Proposed for presentation at Joint Lubrication Conf., Atlanta, 16-18 Oct. 1973; cosponsored by Am. Soc. of Lubrication Engr. and the ASME
(NASA-TM-X-68265; E7566) Avail: NTIS HC $3.50 CSCL 13I

Seven 150-mm bore ball bearings were run under 8900 Newton (2000 lb) thrust load at speeds from 6670 to 20,000 rpm (1 to 3 million DN). Four of the bearings had conventional solid balls and three bearing had drilled (cylindrically hollow) balls with 50 percent mass reduction. The bearings were under-race cooled and slot-lubricated with Type 2 ester oil at flow rates from 4.35 to 5.80 liters per minute (1.15 to 1.57 gal/min). Friction torque and temperatures were measured on all bearings. No significant difference in torque was noted, between the solid and drilled ball bearings. One bearing of each type was rerun at 17,800 Newtons (4000 lb) thrust load. The solid ball bearings performed satisfactorily at 3 million DN. However, at about 2 million DN the drilled ball bearing experienced a broken ball and cracks appeared in two other balls as the result of flexure fatigue. Metallurgical examination of the cracked balls indicated a brittle structure in the bore of the drilled balls.
Author

N73-26481*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircarft Div.
DEVELOPMENT OF HELICOPTER TRANSMISSION SEALS, TASK 2
T. S. Hayden and C. H. Keller, Jr. Jul. 1973 78 p ref Sponsored in part by Army Air Mobility R and D Lab.
(Contract NAS3-15684)
(NASA-CR-120983; SER-50776) Avail: NTIS HC $6.00 CSCL 11A

High speed helicopter transmission seal concepts were designed, fabricated and tested. The concepts were a dual element split ring seal and a circumferential seal. The tests were performed in a rig using an actual input quill assembly. The test conditions were selected to simulate transmission operation and were 230 F oil temperature, and a sliding speed of 9400 ft/min. The split ring seal exhibited gross leakage and was considered unsatisfactory, while the circumferential seal leakage was less than 1 c.c./hour; this leakage is within acceptable limits. The circumferential seal wear was only to .0005 inches during a 100 hour run (40 starts and stops). During a 40 hour contamination test (mesh silica flour) the seal total wear was a maximum of .004 inches. This wear is considered acceptable. Author

N73-26482*# SKF Industries, Inc., King of Prussia, Pa. Research Lab.
DYNAMIC AND THERMAL ANALYSIS OF HIGH SPEED TAPERED ROLLER BEARINGS UNDER COMBINED LOADING
W. J. Crecelius and D. R. Milke Mar. 1973 125 p refs
(Contract NAS3-15700)
(NASA-CR-121207; SKF-AL73P010) Avail: NTIS HC $8.25 CSCL 13I

The development of a computer program capable of predicting the thermal and kinetic performance of high-speed tapered roller bearings operating with fluid lubrication under applied axial, radial and moment loading (five degrees of freedom) is detailed. Various methods of applying lubrication can be considered as well as changes in bearing internal geometry which occur as the bearing is brought to operating speeds, loads and temperatures. Author

N73-26483*# AiResearch Mfg. Co., Phoenix, Ariz.
SMALL, HIGH PRESSURE RATIO COMPRESSOR: AERODYNAMIC AND MECHANICAL DESIGN
C. A. Bryce, J. R. Erwin, G. L. Perrone, E. L. Nelson, R. K. Tu, and A. Bosco Jun. 1973 131 p refs
(Contract NAS3-14306)
(NASA-CR-120941; APS-5404-R-Vol-1) Avail: NTIS HC $8.75 CSCL 13I

The Small, High-Pressure-Ratio Compressor Program was directed toward the analysis, design, and fabrication of a centrifugal compressor providing a 6:1 pressure ratio and an airflow rate of 2.0 pounds per second. The program consists of preliminary design, detailed areodynamic design, mechanical design, and mechanical acceptance tests. The preliminary design evaluate radial- and backward-curved blades, tandem bladed impellers, impeller-and diffuser-passage boundary-layer control, and vane, pipe, and multiple-stage diffusers. Based on this evaluation, a configuration was selected for detailed aerodynamic and mechanical design. Mechanical acceptance test was performed

to demonstrate that mechanical design objectives of the research package were met. Author

N73-26484*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION LOSSES IN A LUBRICATED THRUST-LOADED CAGELESS ANGULAR-CONTRACT BEARING
Dennis P. Townsend, Charles W. Allen, and Erwin V. Zaretsky Washington Jul. 1973 37 p refs
(NASA-TN-D-7356; E-7284) Avail: NTIS HC $3.00 CSCL 13I

The NASA spinning torque apparatus was modified to measure the spinning torque on a cageless ball thrust bearing. Friction torque was measured for thrust loads varying from 44.5 to 403 newtons (10 to 90 lb) at speeds of 1000, 2000, and 3000 rpm. Tests were conducted with di-2-ethylhexyl sebacate and a synthetic paraffinic oil. These tests were run with either oil jet lubrication or with a thin surface film of lubricant only. An analytical model which included rolling resistance was developed and extended from previous models for spinning torque and lubricant rheology. The model was extended by the inclusion of rolling resistance. The computed values were in fair agreement with the experimental results and confirmed previous hypotheses that a thin lubricant film gives minimum bearing torque and an oil jet flow of a viscous lubricant will result in considerable rolling torque in addition to the torque due to ball spin. Author

N73-26485# Los Alamos Scientific Lab., N.Mex.
FABRICATION AND PROPERTIES OF TUNGSTEN-60 VOL PRECENT LEAD HOLLOW CYLINDERS
H. Sheinberg and T. I. Jones Jan. 1973 12 p
(Contract W-7405-eng-36)
(LA-511) Avail: NTIS HC $4.00

The development of an inexpensive high-density tungsten-lead composite is reported. Details of fabrication and testing of long, thin walled cylinders of W-60 vol % Pb are described. It was demonstrated that a hydrostatically pressed mixture of power yielded a product that met the high density, low cost, ease of fabrication, and mechanical property goals. Author (NSA)

N73-26486# Oak Ridge National Lab., Tenn.
UNCONVENTIONAL WELDING PROCESS: A BIBLIOGRAPHY
R. M. Stemple, comp. Mar. 1973 68 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4133) Avail: NTIS HC $5.50

The newer methods for welding have been termed unconventional to differentiate them from the older ones, and include electron beam, ultrasonic, laser beam, and friction welding. This bibliography brings together the world literature on these processes through 1971. A separate section is devoted to each process, and the arrangement is by author with an introduction and key-word index. When an article or paper is authored by more than three individuals, only the first is cited. Indexing and abstracting services searched were: Applied Science and Technology Index, Chemical Abstracts, Engineering Index, Internationl Aerospace Abstracts, Nuclear Science Abstracts, Metals Abstracts, STAR, TAB, Titanium Abstracts, and U.S. Government Reports Index. Author (NSA)

N73-26487# British Aircraft Corp. (Operating) Ltd., Bristol (England). Electronics and Space Systems Group.
A STUDY OF NON-DESTRUCTIVE TESTING OF WELDED SOLAR CELL INTERCONNECTIONS, 1 APRIL - 30 SEPTEMBER 1972
R. M. Jenkins, H. J. A. MacKillican, and D. G. Powley Oct. 1972 84 p refs
(Contract ESTEC-1507/71-HP)
(ESS/SS-397; ESRO-CR(P)-159) Avail: NTIS HC $6.25

The applicability of a number of preferred nondestructive test techniques for in-line quality control of welded silver interconnections to silicon solar cells is investigated. The description and implementation of the selected test methods are given together with the evaluation program consisting of the objectives, description, results and discussion of the tests. ESRO

N73-26488# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LUMINESCENT AND COLOR FLAW DETECTION (SELECTED PARTS)
A. V. Karyakin and A. S. Borovikov 10 Apr. 1973 66 p refs Transl. into ENGLISH from the publ. "Lyuminestsentnaya i Tsvetinaya Defektoskopiya" Moscow, Mashinostr., 1972 p 189-225 and 233-238
(AD-759253; FTD-MT-24-1774-72) Avail: NTIS CSCL 14/2

The report describes methods of nondestructive testing, utilizing magnetic particle and dye penetrate detection, employed by the United States, Japan, Great Britain, and Russia. GRA

N73-26489# Midwest Research Inst., Kansas City, Mo.
THE EFFECT OF WEAR ON THE COMPRESSIVE STRESS IN THE SPHERE-ON-PLANE AND MULTIPLE-FLAT-ON-CURVE CONFIGURATIONS Technical Report, 3 Jan. - 1 Nov. 1972
Karl R. Mecklenburg Feb. 1973 63 p refs
(Contract F33615-72-C-1374; AF Proj. 7340; AF Proj. 7343)
(AD-759560; AFML-TR-73-39) Avail: NTIS CSCL 11/8

Graphite fluoride, a proposed solid lubricant material, performed differently on two types of machines. An examination of the wear processes in both machines was undertaken to reconcile the difference. A burnished film of graphite fluoride was used to lubricate the sphere-on-plane (pin-on-disc) and multiple-flat-on-curve (Falex) test configurations. Compressive stress and sphere wear volume were determined as a function of time from the wear scar area on the sphere, measured at various times. Friction coefficients were also determined for the sphere-on-plane test. The initial and final (static) compressive stress values for the multiple-flat-on-curve test configuration were determined. Differences in wear scar areas on the two faces of the vee block were observed. (Author Modified Abstract) GRA

N73-26490# Bell Helicopter Co., Fort Worth, Tex.
LOW-TEMPERATURE TESTS OF ELASTOMERIC BEARING ROTORS ON AN OH-58 HELICOPTER IN THE CLIMATIC LABORATORY AT EGLIN AFB
C. H. Fagan Feb. 1973 50 p refs
(Contract DAAJ02-72-C-0058; DA Proj. 1F1-62205-A-119)
(AD-759957; BHC-299-099-587; USAAMRDL-TR-73-9) Avail: NTIS CSCL 13/9

The results of a program conducted to investigate the low-temperature characteristics of rotors equipped with elastomeric bearing are reported. An all-elastomeric, two-bladed main rotor and a production tail rotor, with elastomeric bearings installed in the flapping axis, were tested on an OH-58 helicopter. Tests were conducted at temperatures of 70F, 0F, -25F, -45F, -55F, and -65F. Two main rotor pitch-change bearing configurations were evaluated. The first was fabricated from natural-rubber elastomer and the other from broad-temperature-range elastomer. (Author Modified Abstract) GRA

N73-26491# Kentucky Univ., Lexington.
PROJECT THEMIS: METAL DEFORMATION PROCESSING Annual Report, Sep. 1971 - 31 Aug. 1972
Hans Conrad and Mehmet Doner Feb. 1973 107 p refs
(Contract F33615-69-C-1027)
(AD-759830; AFML-TR-72-272; AR-4) Avail: NTIS CSCL 13/8

The objectives of the program were: To develop computer programs that will yield realistic solutions to metalworking equations by adequately accounting for work hardening, strain rate, thermoplasticity, friction, geometry, size effects and anisotropy; To determine the materials parameters in the metalworking equations; To interpret the material behavior during metalworking; To evaluate in detail the microstructure through all stages of metalworking; To evaluate friction and lubrication in metalworking. GRA

N73-26492# Lockheed Missiles and Space Co., Sunnyvale, Calif.
EVALUATION OF NITINOL FITTINGS FOR JOINING TITANIUM PIPING FOR SHIPBOARD APPLICATIONS Final Report, 9 Mar. 1972 - 8 Apr. 1973
Marsh K. Eckhardt 30 Apr. 1973 60 p refs

(Contract N00024-72-C-5336)
(AD-760322; LMSC-D350045) Avail: NTIS CSCL 13/5

Basic tests were made of Cryofit heat shrinkable fittings used with C.P. titanium and Ti-3Al-2.5V tube. Tests included flexural fatigue, tensile, burst, torsion and crevice corrosion. Tube sizes of 1.90 in. and 4.0 in. diameter were tested. There were no fitting failures, and flexural life degradation by the fitting was under 10% with Ti-3Al-2.5V tube and less than 20% with C.P. grade 3 tube. The fitting designs were based on 3000 psi aircraft hydraulic system requirements and it is believed even better results might be obtained with designs modified to suit lower pressure Navy systems. The Cryofit fittings can be used with Ti-3Al-2.5V and commercially pure tubing up to 4 in. diameter except in systems of safety significance, i.e., per MIL-STD-882, Class IV or Class III. With further in-depth testing, they could probably be used in any system as original installation or retrofit. Author (GRA)

N73-26493# Stanford Univ., Calif. Dept. of Statistics.
EFFICIENCY-ROBUST ESTIMATION METHODS FOR RELIABILITY Progress Report, 1 Oct. 1971 - 30 Sep. 1972
M. Vernon Johns Apr. 1973 24 p refs
(Contract F44620-72-C-0012; AF Proj. 9769)
(AD-760152; AFOSR-73-0741TR) Avail: NTIS CSCL 14/4

The main investigative effort has been concentrated in two closely related directions. The first is concerned with the robust estimation of the location of the center of a symmetric distribution. The approach to this problem has been to investigate theoretical and empirical refinements of an adaptive estimator previously proposed by the principal investigator. The second problem area considered is concerned with the robust estimation of a specified quantile (reliable life) for nonsymmetric life distributions not specified in parametric form. The results demonstrate the essential irrelevance for this problem of the sort of large sample optimality considerations appropriate to the symmetric case, and alternative approaches suitable for finite sample sizes are explored. Author (GRA)

N73-26494# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INDUCTIVE REACTANCES OF A CRYOGENIC SYNCHRONOUS MACHINE WITH A FERROMAGNETIC SCREEN
A. I. Bertinov, O. M. Mironov, and A. V. Golovkin 6 Apr. 1973 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Enegr. i Transp. (Moscow), no. 4, 1972 p 61-65
(AD-759879; FTD-MT-24-68-73) Avail: NTIS CSCL 13/9

The fundamental inductive reactances of a direct sequence of a synchronous machine having cryogenic winding cooling with a ferromagnetic screen-magnetic circuit are determined; the engineering methods of their calculation are given as well. The results of the analyses are compared with the parameters of similar machines without a screen. Author (GRA)

N73-26495# Army Weapons Command, Rock Island, Ill. Weapons Lab.
APPLICATION OF NEW PROCESS TECHNOLOGY TO THE MANUFACTURE OF HOT-WOUND SPRINGS
Samuel L. Williams Dec. 1972 54 p refs
(AD-759906; SWERR-TR-72-61) Avail: NTIS CSCL 19/6

The feasibility of using induction heating and concomitant quenching for hot winding large helical springs was established. A full-scale experimental system was assembled, and M140 gun mount counterrecoil springs were coiled from three different materials. Springs with proper load-carrying capacity were produced from each of the materials. Author (GRA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-26496 California Inst. of Tech., Pasadena.
DETECTION OF MODE-LOCKED LASER SIGNALS Ph.D. Thesis
Robert Joseph Dorazio 1973 155 p
Avail: Univ. Microfilms Order No. 73-1526

Matched-filtering for mode-locked laser signals is discussed. The optical receiver consists of a passive laser cavity controlled in length and a photodetector with its associated electronics. The length of the passive Fabry-Perot cavity is chosen roughly equal to the cavity length of the transmitting laser, but with provision for fine fractional wavelength control of its length. In addition to the selective filtering characteristics of the passive cavity (passbands of unity transmission matching the frequencies of the multi-mode laser), a readout of the vernier length control, peaking the output, provides for an extremely wide range of velocity measurements with either an active or passive vehicle moving relative to the receiver. The matched-filter criterion resulting from the optimization of the signal-to-noise ratio was used. Dissert. Abstr.

N73-26497 Wisconsin Univ., Madison.
CALCULATION OF DOUBLY SCATTERED LIDAR RETURNS Ph.D. Thesis
Ewin Walter Eloranta 1972 122 p
Avail: Univ. Microfilms Order No. 72-24877

A lidar transfer equation is developed describing the magnitude and polarization of the doubly scattered return signal resulting from the illumination of a homogeneous cloud of spherical particles. Evaluation of the resulting multiple integral for water clouds with model particle size distributions indicates that a significant fraction of the received lidar return is due to double scattering. Both the magnitude and polarization of the calculated return are presented. The doubly scattered lidar return is shown to be strongly dependent on the ratio of the receiver acceptance angle to the angular width of the forward scattering peak caused by light diffracted around the cloud droplets. Special case solutions to the double scatter transfer equation are presented. These solutions provide a convenient way to estimate the magnitude of the doubly scattered return for routine lidar work. Dissert. Abstr.

N73-26498 California Univ., Los Angeles.
HOLOGRAPHY AS APPLIED TO JET BREAKUP AND AN ANALYTICAL METHOD FOR REDUCING HOLOGRAPHIC DROPLET DATA Ph.D. Thesis
Daweel Joseph George 1972 276 p
Avail: Univ. Microfilms Order No. 72-33924

The use of holography in studying certain fluid mechanics problems was investigated. The holographic technique can record a flow field in three dimensions by one pulse of a laser. This effort specifically examined the application of holography to: (1) high speed (supersonic) flow fields by injecting different liquid jets perpendicularly into a Mach 3 gas stream to observe how jet breakup occurs, and (2) the atomization characteristics (droplet size and spatial distribution) of a liquid jet injected into quiescent, atmospheric air. Five liquids (water, trichloroethylene, Freon 113, methanol and water/photoflo solution) were injected individually through different sized orifices. The variables of interest were wind tunnel total pressure, liquid type, orifice diameter and liquid injection velocity. Dissert. Abstr.

N73-26499 Texas Univ., Austin.
MEASUREMENT OF THE SPATIAL DISTRIBUTION OF ATMOSPHERIC WATER VAPOR USING A RUBY LASER Ph.D. Thesis
Michael McFarland Johnson 1972 142 p
Avail: Univ. Microfilms Order No. 73-462

Theoretical and experimental work on the development of a ruby laser radar system for measuring the spatial number density distribution of atmospheric water vapor is presented. The basic spectroscopic technique for determining the number density spatial distribution from measurements of the differential absorption of monochromatic radiation is reviewed and the theory is extended to explicity account for temperature and pressure variations along the measurement path. The theoretical requirements for making multi-surfaced (resonant) reflectors frequency tunable were verified using computer generated reflectance curves. Fabry-Perot ring analysis showed that a four surface reflector (two sapphire flats) with a satellite spacer having close to the ideal thermal expansion coefficient, for thermal frequency tunability, could be used to continuously tune a ruby laser more than 0.3 A with a spectral stability and width less than + or - 0.01 A. Dissert. Abstr.

N73-26500*# National Academy of Sciences - National Research Council, Washington, D.C.
HOLOGRAPHIC DEVICE Patent Application
James J. Cowan, inventor (to NASA) Filed 31 May 1973 11 p
(NASA-Case-MFS-22040-1; US-Patent-Appl-SN-365644) Avail: NTIS HC $3.00 CSCL 20E

A technique for producing holograms by using the propagation of a surface wave within a layer of photosensitive material is described. The photographic emulsion is placed on a metal grating and the metal is chosen to have a plasma wave length which lies at a shorter wavelength than the spectral region of the light from the laser used with it. Diagrams of the system are provided. NASA

N73-26501# Lockheed Missiles and Space Co., Palo Alto, Calif.
EXPERIMENTAL INVESTIGATION OF FLUCTUATIONS IN THE DIFFERENCE FREQUENCY OF A RING LASER
N. A. Markelov, V. A. Rogachev, and A. A. Turkin [1973] 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), v. 16, no. 4, 1973 p 545-551
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Fluctuations in the difference frequency of ring lasers operating in the single mode regime are described. The method and apparatus used to investigate the frequency difference fluctuations are described. Spectral densities of the frequency fluctuations were measured by a spectrum analyzer. The instrument permits investigation of signals with frequencies of approximately 8 to 100 kHz without retuning. The lower limit is determined by the highest frequency of observation of the fluctuation spectrum and should exceed it by approximately an order of magnitude. Author

N73-26502*# Laval Univ. (Quebec). Quantum Electronics Lab.
RUBIDIUM-87 GAS CELL STUDIES, PHASE 2 Semiannual Status Report, 1 Aug. 1972 - 1 Mar. 1973
Jacques Vanier Mar. 1973 49 p refs Sponsored in part by NRC
(Grant NGR-52-133-001)
(NASA-CR-132770) Avail: NTIS HC $4.50 CSCL 20E

A description is given of the development of a compact rubidium-87 maser. Data cover the electronic control system for the maser itself and a superhetrodyne receiver capable of locking a crystal oscillator to the maser signal. E.H.W.

N73-26503*# Florida Univ., Gainesville. Dept. of Nuclear Engineering Sciences.
RESULTS OF AN EXPERIMENTAL INVESTIGATION ON DIRECT NUCLEAR PUMPING OF GAS LASERS BY FISSION FRAGMENTS
Roy A. Walters and Richard T. Schneider Jan. 1973 14 p refs
(Grant NGL-10-005-089)
(NASA-CR-133210) Avail: NTIS HC $3.00 CSCL 20E

An experiment investigating direct nuclear pumping of a gas laser using argon as lasing medium is described. Results show that light output in the form of a directional beam was obtained. Author

N73-26504# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
EFFECTS OF OPTICAL COMPONENTS ON THE TRIGGERING OF SPARK GAPS BY A LASER BEAM
M. Pillsticker Nov. 1972 42 p refs In GERMAN; ENGLISH summary
(IPP-4/102) Avail: AEC Depository Libraries

The different initial triggering conditions observed by investigations of high voltage spark gap triggering with laser light of 10600 A are studied. Measurements on optical laser parameters are discussed from this point of view. Furthermore, the technical usefulness of certain devices is pointed out. The given results render the necessary optimized values for optical parameters as far as a technical application is desired. Author (NSA)

N73-26505# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
HIGH-POWER CO2 TEA LASER STUDIES
P. Oettinger Aug. 1972 25 p refs
(LRP-54/72) Avail: AEC Depository Libraries

The need for a good interferometric and light-scattering plasma-diagnostic radiation source has resulted in a program to construct high-power, TEA, CO2 lasers. A resistance-limited, 1.2-m long, pin-plate, plane-parallel oscillator, with a 4-cm electrode separation, has yielded maximum powers of 20 MW, energies approaching 2 J, and electrical-to-radiation efficiencies near 9%. Optimum CO2:N2:He gas composition was found to be 1.5:1.5:7, operated at atmospheric pressure. Current pulse durations for the 60 kV discharges approximated 1 microsec, with maximum amplitudes of 18 A per pin. Onset of lasing occurred near the end of the discharge with pulse half-widths of 60 to 150 ns. Increasing the electrode separation to 6 cm, doubling the capacitance of the system, and changing the gas composition to a 0.4-atmosphere 1:1:2 mixture doubled the output energy. Author (NSA)

N73-26506# Institute of Nuclear Research, Warsaw (Poland).
MEASUREMENTS OF PLASMA DENSITY WITH LASER INTERFEROMETRY METHODS
J. Appelt and M. Sadowski 1972 66 p refs In POLISH; ENGLISH summary
(INR-1442) Avail: AEC Depository Libraries $5.25

The physical principles of interferometric methods used for plasma diagnostics are discussed, and the systems of conventional interferometers with laser sources and of laser three-mirror interferometers are presented. The laser interferometers designed and constructed in the Hot Plasma Physics Laboratory are described, and the results of preliminary investigations performed with those devices are given. A comparison of different interferometric methods is carried out, and various factors that influence the use of these methods are discussed. Author (NSA)

N73-26507# Los Alamos Scientific Lab., N.Mex.
LASER MODULATOR
G. N. Rupert and L. R. Newkirk Feb. 1973 4 p refs
(Contract W-7405-eng-36)
(LA-5166-MS) Avail: NTIS HC $3.00

An all-electric modulator circuit which controls the output power of a commercial laser with faithful reproduction of the 5 Hz input sinusoidal waveform is described. Four inexpensive operational amplifiers are used in a pulsewidth modulation system operating at 4000 Hz. The on-off ratio of each 250 micro sec segment of 5 V output waveform varies at the modulation frequency. Improved results are obtained over the electro-mechanical system previously used. Author

N73-26508# Los Alamos Scientific Lab., N.Mex.
CO2 GAS LASER STUDIES
C. B. Mills Jan. 1973 37 p refs
(Contract W-7405-eng-36)
(LA-5151) Avail: NTIS

Laser gain measurements were used to improve published molecular vibration excitation and relaxation rates for a CO2 gas, electron-beam-controlled, laser amplifier. The equations of plasma current continuity and molecular excitation energy conservation were solved for cold, dense (STP), gaseous plasma, and the populations of excited levels were used to compute laser gain as a function of time. Parametric differences from experiment for a wide range of He, N2, and CO2 gas mixtures, over the range of plasma currents of 1 to 10 amp/cm sq and potential gradients of 1 to 10 kV/cm, permitted the improvement of rate constants available from other work. Errors in laser gain as a function of time are + or - 10% for a wide variety of conditions with the modified rate constants. The plasma current computed agreed well with measurements for the developing plasma, and the cathode sheath potential drop was shown to be 400 to 2400 volts, consistent with experimental inference. Author (NSA)

N73-26509# Los Alamos Scientific Lab., N.Mex.
MULTIPASS SYSTEMS FOR CO2 LASER PLASMA HEATING AND DIAGNOSTIC SCATTERING EXPERIMENTS

S. Humphries, Jr. Feb. 1973 24 p refs
(Contract W-7405-eng-36)
(LA-5167-MS) Avail: NTIS HC $3.25

Calculations are presented on a laser-plasma system in which the plasma is located within a high-Q laser cavity, maximizing the useful radiation density. The stability of cavities with the inclusion of a cylindrical pinch plasma is investigated for propagation along and across the column. Conditions are given under which the presence of the plasma is necessary for cavity oscillations, raising the possibility of plasma Q-switching. Calculations are performed on the expected shape of laser modes in the plasma, taking the plasma dynamics into account. It is shown that these modes are unfavorable to heating of the bulk of the plasma, and are unstable against hydromagnetic kinking. A heating experiment using a small pinch and modest laboratory laser is described that would allow measurement of low-density laser-plasma interactions and many transport properties of fully ionized plasmas. Feasibility studies are also presented on the use of closed-cavity CO2 scattering to measure the ion temperature in pinches. Author (NSA)

N73-26510# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
[USEFUL FREQUENCY SPECTRUM EXTENSION MICROWAVE AND OPTICAL FREQUENCIES] Consolidated Quarterly Report, 1 Apr. - 30 Jun. 1972
J. R. Boye, O. P. Gandhi, R. W. Grow, J. L. Hou, and W. G. Krigbaum 30 Jun. 1972 94 p refs
(Contract N00014-69-C-0345; N00014-67-A-0325-0005; Grants DA-ARO(D)-31-124-71-G111; NSF GK-16574; NR Proj. 373-740)
(AD-759066; MDL-Q41; UTEC-MD-73-002) Avail: NTIS CSCL 20/5

The broad purpose of the research activity reported herein is to extend the useful frequency spectrum into the range from microwave frequencies to optical frequencies and to improve existing devices and techniques in the microwave spectrum. At present this objective is being pursued by studies of electron beam devices, quantum electronic devices, plasmas, and solid-state devices. Author (GRA)

N73-26511# Stanford Research Inst., Menlo Park, Calif.
LIDAR OBSERVATIONS OF SLANT RANGE VISIBILITY FOR AIRCRAFT LANDING OPERATIONS
William Viezee, John Oblanas, and Ronald T. H. Collis 28 Feb. 1973 47 p refs
(Contract F19628-71-C-0152; AF Proj. 6670)
(AD-760128; AFCRL-TR-73-0146; SR-1) Avail: NTIS CSCL 04/2

During July 1972, a scanning ruby lidar was operated in support of the AFCRL fog field program at Vandenberg AFB, California. In addition to observations made during thermal fog dispersal tests, backscatter data were collected during 14 separate periods of dense natural fog. Values of slant visual range computed from these data are compared with information on the visibility conditions obtained from available AFCRL instrumentation. Although no detailed,quantitative evaluation of the lidar observation was feasible, the data comparison shows that the lidar provided visibility information compatible with that supplied by the more conventional measuring devices. Author (GRA)

N73-26512# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CO LASER. RESULTS OF EXPERIMENTAL INVESTIGATIONS
N. N. Sobolev and V. V. Sokovikov 19 Apr. 1973 51 p refs Transl. into ENGLISH from Akad. Nauk SSSR Fiz. Inst. Tr. (USSR), no. 33, 1972 p 1-63
(AF Proj. 649L)
(AD-759861; FTD-MT-24-1735-72) Avail: NTIS CSCL 20/5

Until recently the most outstanding representatives of gas lasers have been the CO2- and Ar--lasers, to which survey articles have been dedicated. At the present time, to these two lasers it is also possible to add the CO-laser, which with respect to power is comparable to the Ar--laser, and in efficiency to the CO2-laser. The results of the developments and investigations of CO-lasers are presented in the first part of the proposed article. The second part will be dedicated to the inverse population formation mechanism in CO-lasers. GRA

N73-26513# ARO, Inc., Arnold Air Force Station, Tenn.
SPECIE NUMBER DENSITY, PILOT PRESSURE, AND FLOW VISUALIZATION IN THE NEAR FIELD OF TWO SUPERSONIC NOZZLE BANKS USED FOR CHEMICAL LASER SYSTEMS Final Report, 11 Mar. 1971 - 5 May 1972
D. L. Whitfield, J. W. L. Lewis, W. D. Williams et al AEDC May 1973 199 p refs
(AD-760132; ARO-VKF-TR-73-11; AEDC-TR-73-11) Avail: NTIS CSCL 20/5

An experimental investigation of the gas dynamics in the near field of two supersonic nozzle banks used for chemical laser systems was conducted in the von Karman Gas Dynamics Facility (VKF) of the AEDC. The exhaust gases were simulated by mixtures of hydrogen, helium, and nitrogen. Pitot pressure measurements were made, and the electron beam fluorescence technique was used to obtain specie number density and flow visualization photographs. In addition, a few velocity measurements were made using the laser Doppler velocimeter measuring technique. An analytical investigation of the flow inside the nozzles for various reservoir conditions was also conducted. (Author Modified Abstract) GRA

N73-26514# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE STABILITY OF A SINGLE-FREQUENCY LASER
N. D. Milovskii [1973] 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), v. 16, no. 4, 1973 p 537-544
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The stability of a single frequency traveling wave laser using a homogeneously broadened active material is investigated. The detuning of the generation frequency from the center of the material line is taken into account. The passing and opposing perturbations are considered. It is shown that for any arbitrarily small detuning there appear two instability domains in the pumping parameter. Mathematical models are developed to support the theoretical concepts. Author

N73-26515# Lockheed Missiles and Space Co., Palo Alto, Calif.
DETECTION AND MEASUREMENT OF SMALL BACK REFLECTIONS OF LASER RADIATION
I. L. Bershtein and D. P. Stepanov [1973] 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), v. 16, no. 4, 1973 p 531-536
Avail: NTIS

An apparatus to determine small coefficients of back reflection of laser radiation is described. The results of inspecting backscattering from a number of optical elements are presented. The equipment is used primarily for verification of the quality of diverse optical elements. Mathematical models are provided to support the theoretical concepts. A diagram of the apparatus is included. Author

N73-26516# Lockheed Missiles and Space Co., Palo Alto, Calif.
EFFECT OF A REFLECTED SIGNAL ON LASER OPERATION
I. L. Bershtein [1973] 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (USSR), v. 16, vo. 4, 1973 p 526-530
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Changes in the amplitudes and frequencies of laser oscillations due to the effect of a weak reflected signal are computed. The threshold value of the reflected signal which is detectable by means of the system reaction is determined. The condition of stationary amplitudes on the inner surface of the output mirror is considered. Mathematical models are developed to support the theoretical considerations. Author

N73-26517# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
[USEFUL FREQUENCY SPECTRUM EXTENSION THROUGH

ELECTRON BEAM, PLASMA, AND SOLID STATE DEVICE STUDIES] Consolidated Quarterly Report, 1 Jul. - 30 Sep. 1972
J. R. Boye 30 Sep. 1972 79 p refs
(Contracts N00014-69-C-0345; N00014-67-A-0325-0005; Grants DA-ARO(D)-31-124-71-G111; NSF GK-16574; NR Proj. 373-740)
(AD-760033; MDL-042; UTEC-MD-73-015) Avail: NTIS CSCL 20/5

The broad purpose of the research is to extend the useful frequency spectrum into the range from microwave frequencies to optical frequencies and to improve existing devices and techniques in the microwave spectrum. At present this objective is being pursued by studies of electron beam devices, quantum electronic devices, plasmas, and solid-state devices.
Author (GRA)

N73-26518# Radio Corp. of America, Princeton, N.J. David Sarnoff Research Center.
MATERIALS FOR PHASE HOLOGRAPHIC STORAGE Final Report, 29 Dec. 1971 - 28 Dec. 1972
David L. Staebler, William Phillips, and Brian W. Faughnan Mar. 1973 54 p refs
(Contract N00019-72-C-0147)
(AD-760343; PRRL-73-CR-17) Avail: NTIS CSCL 09/2

The report describes recent advances in the understanding and performance of iron-doped lithium niobate as a holographic-storage medium. The major results reported here are: (a) the identification of a self-consistent model for hologram storage, fixing, and erasure in this material; (b) a theoretical analysis using this model concerning methods for improving the sensitivity and fixing performance; and (c) the development and refinement of new crystal preparation techniques. As a result of these efforts, significant advances have been made in the performance of Fe-doped LiNbO3 for both read-only and read-write applications. In addition, preliminary results are presented on a new storage material, photochromic lithium niobate. Author (GRA)

N73-26519# Hughes Research Labs., Malibu, Calif.
LASER INDUCED DAMAGE IN OPTICAL MATERIALS Semiannual Technical Report
Concetto R. Giuliano Jan. 1973 62 p refs
(Contract F19628-72-C-0348; ARPA Order 2042; AF Proj. 2042)
(AD-760131; AFCRL-TR-73-0099) Avail: NTIS CSCL 20/6

The report describes the results of surface damage experiments performed at 1.06 micrometer on proustite (Ag_3AsS_3) and at 0.694 micrometer on sapphire (alpha-Al_2O_3). A discussion of surface damage morphology of proustite for cw and pulsed illumination is illustrated using optical and scanning electron micrographs. A series of damage threshold studies on ion beam polished sapphire was performed as a continuation of work performed on an earlier program. (Author Modified Abstract)
GRA

N73-26520# GTE Sylvania, Inc., Mountain View, Calif.
TUNABLE LASER RESEARCH Final Report, 15 Mar. 1972 - 15 Mar. 1973
Joel Falk, J. Michael Yarborough, and Eugene O. Ammann 15 May 1973 48 p refs
(Contract N00014-72-C-0245)
(AD-760018) Avail: NTIS CSCL 20/5

The report summarizes the results of a twelve month research program to investigate various high power, tunable nonlinear optical devices, including parametric generators and dye lasers, and to investigate efficient second and fourth harmonic generation of Nd:YAG lasers. During the program, tunable parametric generators capable of covering the entire range from 0.4 micrometers to 4 micrometers were constructed, 40% energy conversion from 1.06 micrometers to 0.53 micrometers was achieved, 1 watt average powers were achieved at 0.266 micrometers and tunable dye lasers with up to 300 mJ/pulse with a pulse length of less than 8 nsec were demonstrated.
Author (GRA)

N73-26521# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SOME FURTHER NUMERICAL STUDIES OF LASER INDUCED MELTING AND VAPORIZATION
Peter J. Torvik Jan. 1973 39 p refs
(AD-760113; AFIT-TR-73-1) Avail: NTIS CSCL 20/13

A method for predicting the melting through time for a metal sheet subjected to a continuous laser beam of Gaussian distribution of arbitrary size and peak intensity is given. The effect of completely retained and instantaneously removed melt layers on the melt through time are considered. It is shown that melt through time and the influence of retained melt are dependent on the value of a dimensionless variable representing power per unit thickness. The partial melting and vaporization of sheets by a large single pulse is also discussed and compared with experimental results. Author (GRA)

N73-26522# Sanders Associates, Inc., Nashua, N.H. Electro-Optics Div.
SEGMENTED HIGH AVERAGE POWER Ho (3 PLUS):YLF LASER Final Technical Report, 8 Nov. 1971 - 31 Dec. 1972
William C. Fricke 10 May 1973 53 p refs
(Contract N00014-72-C-0137; ARPA Order 1806)
(AD-760019) Avail: NTIS CSCL 20/5

The program was carried out to investigate the possibility of using: FEP Teflon (R) as a transparent solder to hold the laser disk; and, YLF doped with Ho(3+) in a sliced laser configuration to obtain high average power at two micrometers. The results are summarized. The design of the disk laser and fabrication and testing of the laser are presented. GRA

N73-26523# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF OPTICAL GAIN IN GAS DYNAMIC LASER MEDIA Technical Report, 22 Sep. 1971 - 31 Jul. 1972
S. Russell and R. A. Meinzer Kirtland AFB, N. Mex. AFWL Apr. 1973 90 p refs
(Contract F29601-71-C-0053; ARPA Order 1256)
(AD-760390; UARL-L911115-18; AFWL-TR-72-217) Avail: NTIS CSCL 20/5

An experimental program was conducted using a small-scale, arc-augmented gas-dynamic laser with the objective of obtaining comprehensive data for evaluating theoretical predictions of optical gain for such devices over a wide range of potential operating conditions. Included among the program results were attainment of stagnation temperatures higher than those possible in ordinary combustion-driven gas-dynamic lasers, experimental evaluation of the homogeneity of the flow in this device and theoretical determination of the plenum gas composition from the experimentally measured stagnation temperature and pressure. A number of experimental difficulties were encountered during this program which limited the scope of the gain measurements obtained and thereby partially compromised the overall program objective. (Author Modified Abstract)
GRA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-26524 Virginia Univ., Charlottesville.
THE PLASTIC DEFORMATION OF ALPHA-PHASE COPPER-ALUMINUM ALLOYS AS A FUNCTION OF TEMPERATURE AND ORIENTATION Ph.D. Thesis
John Stephen Ahearn 1972 101 p
Avail: Univ. Microfilms Order No. 72-22655

The plastic properties of alpha-phase Cu-Al single crystals were investigated in the early stages of elongation at a constant strain rate at room temperature and at 4.2 K. In all cases, discrete narrow bands of deformation are introduced into the crystals during the tensile tests. The bands are found to consist of clusters of slip terraces which are resolved when replicas are examined with the electron microscope. At 4.2 K, tensile tests were made on square sectioned rods with 321 axial orientations

and (145) and (111) surfaces with the following compositions: 7.5, 10.5 and 13.2 at percent Al. All the crystals showed serrated load-elongation curves with abrupt load drops superimposed on a nearly constant load level. In addition to the recording of load-elongation curves, observations were made of the surface topography of bands of deformation with the Nomarski color contrast interferometer, the Zeiss interference microscope, and with uranium oxide pre-shadowed carbon replicas examined in the electron microscope. Dissert. Abstr.

N73-26525 Virginia Univ., Charlottesville.
MEASUREMENT OF DISLOCATION VELOCITIES IN alpha-PHASE Cu-Al ALLOYS AT LOW TEMPERATURES Ph.D. Thesis
Richardo B. Schwarz 1972 220 p
Avail: Univ. Microfilms Order No. 72-33255

Square-sectioned single crystals of Cu-10.5 at.% Al were deformed in tension at 4.2 K. Deformation proceeds discontinuously by abrupt elongations with accompanying load drops. The displacement of the dislocations involved is completed in less than 3 x .001 sec. The changes produced by these relaxation processes were studied to provide information on the dislocation mechanisms involved. The general structure of the bands of deformation introduced was determined with the Zeiss interference microscope. Narrow bands with a uniform plastic shear strain are introduced by most of the relaxations. The slip terrace structure was studied by replica electron microscopy. The densities and distributions of dislocations within the bands were determined, using the etch pit technique. Dissert. Abstr.

N73-26526*# Fansteel, Inc., Baltimore, Md. Metals Div.
DEVELOPMENT OF DISPERSION STRENGTHENED NICKEL-CHROMIUM ALLOY (Ni-Cr-ThO2) SHEET FOR SPACE SHUTTLE VEHICLES, PART 2
L. J. Klingler, W. R. Weinberger, P. G. Bailey, and S. Baranow Dec. 1972 353 p refs
(Contract NAS3-13490)
(NASA-CR-121164) Avail: NTIS HC $19.75 CSCL 11F

Two dispersion strengthened nickel base alloy systems were developed for use at temperatures up to 1204 C(2200 F); TD nickel chromium (TDNiCr) and TD nickel chromium aluminum (TDNiCrA1). They are considered candidate materials for use on the thermal protection systems of the space shuttle and for long term use in aircraft gas turbine engine applications. Improved manufacturing processes were developed for the fabrication of TDNiCr sheet and foil to specifications. Sheet rolling process studies and extrusion studies were made on two aluminum containing alloys: Ni-16%Cr-3.5%A1-2%ThO2 and Ni-16%Cr-5. 0%A12%ThO2. Over 1600 kg.(3500 lb.) of plate, sheet, foil, bar and extrusion products were supplied to NASA Centers for technology studies. Author

N73-26527*# Prairie View Agricultural and Mechanical Coll., Tex. School of Engineering.
UNDERGRADUATE RESEARCH REPORT
H. Y. Yeh Feb. 1973 77 p refs
(Grant NGR-044-033-022)
(NASA-CR-132203) Avail: NTIS HC $6.00 CSCL 11F

Studies are reported of the probability distribution of yield strength for mild steel, and the application of numerical techniques to solve mechanical vibration problems. Tensile experiments were conducted for 50 cold rolled and 38 hot rolled mild steel rods. Chi-square, Kolmogro-Smirnov and goodness-of-fit methods are used to test the normality or lognormality of the experimental results. As an example of the application of numerical techniques, a nonlinear dash-pot-speing system subjected to seismic excitation is analyzed by using the fourth-order Runge-Kutta integrated method. Author

N73-26528# Royal Aircraft Establishment, Farnborough (England).
AGING RESISTANCE OF LIGHT METAL BONDED JOINTS USING NEW SURFACE TREATMENT METHODS
H.-D. Steffens and W. Brockmann Sep. 1972 24 p refs Transl. into ENGLISH from Adhaesion (Berlin), v. 10, 1971 p 330-338
(RAE-Lib-Trans-1662; BR31672) Avail: NTIS HC $3.25

Aging tests were conducted on light alloys assembled by bonding with synthetic adhesives containing phenol, epoxide, and polyurethane resins. The compounds, both under load and without load, were subjected to damaging environmental influences and artificial and natural weathering over a period of one year. It was shown that conventional aging tests on unloaded adhesives are hardly realistic and may lead to incorrect predictions. The investigation is considered as a starting point for the development of new aging test methods for bonded joints and for the introduction of a suitable surface treatment process for aluminum alloys in the field of metal bonding. Author

N73-26529# Royal Aircraft Establishment, Farnborough (England).
DEFORMATION PROPERTIES OF TITANIUM AND TITANIUM ALLOYS
Hans Buhler and H. W. Wagener Nov. 1972 43 p refs Transl. into ENGLISH from Baender, Bleche, Rohre (Duesseldorf), v. 6, no. 11, 1965 p 625-630, 667-668 and v. 6, no. 12, 1965 p 677-684
(RAE-Lib-Trans-1657; BR32420) Avail: NTIS HC $4.25

The flow curves of two unalloyed titanium series with different degrees of purity and of the titanium alloys TiAl5Sn2.5, TiAl6V4, and TiV13Cr11Al3 were determined by means of an experimental press. The influences of true strain, rate and deformation temperature on the flow stress of the given materials were determined. The dependence of the rate coefficients n = d log kf/d log phi on temperature and on true strain are also described. Author

N73-26530# Royal Aircraft Establishment, Farnborough (England).
THE EMBRITTLEMENT OF ZONE REFINED IRON BY HYDROGEN
M. Cornet, W. Raczynski, and S. Talbot-Besnard Aug. 1972 18 p refs Transl. into ENGLISH from Mem. Sci. Rev. Met. (Paris), v. 69, no. 1, 1972 p 27-33
(RAE-Lib-Trans-1666; BR31671) Avail: NTIS HC $3.00

The embrittlement and ductility of zone refined iron and Armco iron has been examined while charging with hydrogen. Specimens of both materials suffered a reversible embrittlement due to dissolved hydrogen. The irreversible loss of ductility seen in Armco iron was considered to be due to the precipitation of hydrogen. The mechanism of hydrogen uptake and movement within the material causing these effects is discussed. Author

N73-26531# Royal Aircraft Establishment, Farnborough (England).
THE RELATIONSHIPS GOVERNING STRAIN HARDENING IN METALS
L. D. Sokolov and N. P. Dmitriyev Nov. 1972 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metal. (USSR), v. 4, 1971 p 154-159
(RAE-Lib-Trans-1672; BR32624) Avail: NTIS HC $3.00

An analysis of the hardening indices relating to different temperatures and strain rates was carried out using a method of generalisation over a range of temperature and strain rate dependences of stress. For the region of strain ageing the indices A1 and A2 were determined from a sigma (T) graph plotted in semilog coordinates for various degrees of strain. In this case the humps of strain ageing were elminated by a method of extrapolation to the pure metal and the values of A1 and A2 were correspondingly determined as for pure metals. Estimates of the hardening coefficients A1 and A2, the values of epsilon 1 and also the relationships A1,2(theta, epsilon) and epsilon 1(theta, epsilon) were obatined from a number of studies on polycrystalline Zn, Cu, Ga, T1, Er, Tb, Ho, Sc, Lu, Nd, Pr, La, Co, Y, In, Cd, Mg, Ni, Ti, Zr, Ta, Nb, Mo, U1,1a.5 and other metals. Author

N73-26532# Royal Aircraft Establishment, Farnborough (England).
FLOW CURVES AND THEIR CONSIDERATION FROM A METALLURGICAL POINT OF VIEW
R. Siegel and G. Fritzsch Feb. 1973 17 p refs Transl. into ENGLISH from Die Technik (West Germany), v. 24, no. 7, 1969 p 468-472
(RAE-Lib-Trans-1675; BR34101) Avail: NTIS HC $3.00

Various equations used to describe flow curves are first discussed and some of their limitations pointed out. A considera-

tion is then given to some of the structure and temperature dependent variables which influence flow curves. The structure dependent variables discussed are composition, grain size, degree of prestrain, texture and the Bauschinger effect, while the temperature dependent variables discussed are aging, stretch aging, recrystallization, phase transformations and forming in the metastable austenite bay. It is concluded that in the case of cold working, composition, grain size and degree of prestrain are the most important variables. In the case of hot working, the recrystallization temperature and any phase transformations occurring are the most important factors. Author

N73-26533# Royal Aircraft Establishment, Farnborough (England).
A STUDY OF THE ELECTROCHEMICAL AND MECHANICAL PARAMETERS OF THE LOCALISATION OF HYDROGEN IN IRON AND A MARAGING STEEL USING HIGH RESOLVING POWER AUTORADIOGRAPHY
J.-P. Laurent, G. Lapasset, M. Aucouturier, and P. Lacombe Nov. 1972 20 p refs Transl. into ENGLISH from Corros.-Trait., Prot., Finition (France), v. 20, no. 2, 1972 p 113-120
(RAE-Lib-Trans-1665; BR32584) Avail: NTIS HC $3.00

Specimens of Armco iron and a maraging steel were cathodically charged with tritium. Autoradiographs taken after some six days exposure showed heterogeneities in the distribution of the tracer. The electrochemical charging conditions were found to be extremely important and strict control was necessary. It is concluded that migration of hydrogen cannot occur except from trap to trap and that cracks may initiate from such sites. Author

N73-26534# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF GRAIN SIZE ON THE ELASTIC LIMIT OF LOW CARBON AND LOW ALLOY STEELS
A. V. DeSeabra Feb. 1973 16 p refs Transl. into ENGLISH from Metalurgia (Sao Paulo, Brazil), v. 27, no. 168, 1971 p 775-780 Presented at 24 Ann. Conf. of the ABM, Rio de Janeiro, Jun. - Jul. 1971
(RAE-Lib-Trans-1700; BR33629) Avail: NTIS HC $3.00

The apparent contradiction to the Hall-Petch relationship, which is encountered in some published papers led to an investigation being made on four medium carbon steels: one unalloyed and three very low alloy ones of the Cr-Mo-V, Ni-Cr-Mo and Cr-Mo types. Comparable microstructures were obtained with all the steels at all the austenitising temperatures. It was confirmed that the type of microstructure had a significant effect: it appeared that importance must be attributed to the effect of grain size on the elastic limit as soon as the microstructure is in the Ar prime region and especially if the predominant constituent is ferrite. Author

N73-26535# Defence Standards Labs., Maribyrnong (Australia).
THE VARIATIONAL PRINCIPLE OF PLASTICITY
R. L. A. Bish Apr. 1973 33 p refs
(Rept-450) Avail: NTIS HC $3.75

A variational principle of plasticity is found to describe the behaviour of linearly work hardening metals with high precision. The theoretical consequences of the principle are considered. Author

N73-26536# Eidgenossisches Flugzeugwerk, Emmen Switzerland).
STUDY OF THREE HIGH STRENGTH STEELS. THE INFLUENCE OF MARTENSITIC MICROSTRUCTURE ON FATIGUE LIFE
Maria Ronay [1972] 41 p refs
(S-253) Avail: NTIS HC $4.25

The influence of martensitic microstructure on the fatigue life of high strength steels is discussed. The composition and characteristics of the high strength steels used for the fatigue tests are described. The specimens were tested in axial loading where the ratio of compressive to tensile load amplitudes was equal to 0.3 which is an important assumed amplitude ratio in aircraft design. The effect of microstructure on the fatigue crack propagation properties of the steel specimens is also examined. Author

N73-26537# Japan Atomic Energy Research Inst., Tokyo.
DETERMINATION OF ALUMINUM, IRON, COPPER, MOLYBDENUM, MANGANESE, NICKEL, AND COBALT IN BERYLLIUM BY EXTRACTION-PHOTOMETRIC METHODS WITH 8-QUINOLINOL AND OTHER REAGENTS
N. Tamura and K. Motojima Jun. 1972 16 p refs In JAPANESE; ENGLISH summary
(JAERI-1222) Avail: AEC Depository Libraries.

In the determination of impurities in beryllium, extraction-photometric methods were adapted, and the following reagents were used: 8-quinolinol for aluminum, iron, copper, and molybdenum, 2-methyl-8-quinolinol for manganese, dimethylglyoxime for nickel, and zinc diethyldithiocarbamate for cobalt. The reproducibility and accuracy of the methods were satisfactory. The limits of determination of these elements were about a few ppm. Author (NSA)

N73-26538# Joint Publications Research Service, Arlington, Va.
METALS: METHODS OF MECHANICAL AND TECHNOLOGICAL TESTING
14 Jun. 1973 393 p Transl. into ENGLISH from the book "Metally. Metody Mekhan. Tekhnol. Ispytaniy" Moscow, Izd. Standartov, 1972 388 p
(JPRS-59280) Avail: NTIS HC $21.75

A collection of standards on metals and methods of mechanical and technological testing is presented. Detailed information is provided on the following: (1) shape and size of specimen, (2) test equipment, (3) test procedures, (4) measurement of Brinell hardness, (5) microhardness testing by diamond pyramid indentation, (6) bending tests, (7) flanging tests, and (8) tensile tests. Author

N73-26539# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
MECHANICAL PROPERTIES OF A Cr-Mo STEEL STABILIZED WITH Nb-V
G. Brun, G. Colombe, P. Petrequin, P. Millet, and M. Weisz 1972 62 p refs In FRENCH Presented at Autumn Meeting on Met., Chatenay-Malabry, France, 2-5 Oct. 1972
(CEA-CONF-2118; Conf-721063-4) Avail: AEC Depository Libraries

Ferritic steels resistant to high temperature and decarburization by Na were developed for use in the construction of Na-heated steam generators. The following steel was used: 2 1/4 Cr 1Mo Nb V. The austenitizing temperatures were 1000, 1100, and 1200 C and the different cooling rates (between 800 and 500 C) were between 0.045 and 80 C/s. A single tempering treatment was used: 1 hour at 750 C. The mechanical properties determined are: tensile strength, impact resistance (Charpy 5 at room temperature, and creep at 550 C. The structures of thin slices of material were examined by optical and electron microscopy. A correlation was established between the structure and the mechanical properties by controlling the austenitizing temperature, cooling rate, and tempering. Tempered acicular bainite corresponds to a good compromise between brittleness, creep resistance, and tensile strength. NSA

N73-26540# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
SWELLING OF NICKEL IRRADIATED BY MEDIUM ENERGY HEAVY IONS
L. LeNaour and N. Azam 15 May 1972 19 p In FRENCH Presented at Conf. of French Soc. of Electron Microscopy, Nantes, France, 29-31 May 1972
(CEA-CONF-2052; SMG/72/1562; Conf-720570-2) Avail: AEC Depository Libraries

High-purity Ni was irradiated with 500-keV Ni+ ions, and the effect of temperature on the swelling was studied. The swelling peak as a function of temperature was between 600 and 650 C. There does not seem to be any important difference between the effects of irradiation by ions and by neutrons. The form, distribution, evolution of the defects produced have a great similarity. The only notable peculiarity is the displacement toward the higher temperature of the swelling peak. NSA

N73-26541# McDonnell-Douglas Electronics, St. Louis, Mo.
RESEARCH ON COBALT BERYLLIUM ALLOYS

G. Venturello and A. Burdese [1973] 12 p refs Transl. into ENGLISH of "Ricerche Sulle Leghe Cobalto-Berillio", paper presented at the 5th Natl. Congr. of the Italian Assoc. of Met., Venice, 16-19 Sep. 1951
(RFP-Trans-122; Conf-510901-1) Avail: NTIS

A study was made of the entire binary Co-Be system, using micrography, X-ray crystallography, and thermal tests. The effects of heat treatment on the Brinell hardness of three low Be alloys in the alpha solid solution region were determined. The lattice parameter a was found to be 2.607 A for CoBe and 7.66 A for Co5Be21. Micrographs are shown for Be contents from 2 to 57%. A phase diagram for the Co-Be system is presented; the melting points of CoBe and Co5Be21 are 1505 and 1270 C, respectively. NSA

N73-26542# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
FORMATION OF CAVITIES IN NICKEL AND SOME AUSTENITIC STEELS IRRADIATED BY MEDIUM ENERGY HEAVY IONS
N. Azam and L. LeNaour 25 Sep. 1972 25 p In FRENCH Presented at Autumn Meeting on Met., Chatenay-Malabry, France, 2-5 Oct. 1972
(CEA-CONF-2113; Conf-721063-1; SMG-72/1600) Avail: AEC Depository Libraries

Ionic bombardment causes, in several hours, effects in metals comparable to those observed in a reactor after several years. In order to compare the effects of ionic and neutron bombardment, high-purity Ni and some austenitic steels (304, 347, and 316 L) were irradiated with 500-MeV Ni(+) ions. The effects of temperature, preliminary charging with He, and dose were determined. Comparison of results with reactor irradiation indicate that, qualitatively, the phenomena are similar. Differences appear, however, from the quantitative viewpoint. The temperature of the swelling maximum is 100 to 200 C higher than in the case of neutrons. The determination of dose equivalence between ions and neutrons is difficult. Nevertheless, ionic bombardment remains a useful tool for studying the effect of certain parameters on swelling. The technique could be applied to other irradiation effects. Author (NSA)

N73-26543# Commissariat a l'Energie Atomique, Saclay (France).
STUDY OF SWELLING OF METALS UNDER IRRADIATION BY SMALL ANGLE SCATTERING OF X-RAYS: APPLICATION TO ALUMINUM
J.-L. Baron and R. Cadalbert 25 Sep. 1972 16 p refs In FRENCH Presented from Autumn Meeting on Met., Chatenay-Malabry, France, 2 Oct. 1972
(CEA-CONF-2115; Conf-721063-2; SMG-72/1601) Avail: AEC Depository Libraries

The use of small angle scattering of X-rays to study the swelling of metals under irradiation was applied to Al irradiated by fast neutrons. The principle of the method is that the beam of incident X-rays, very fine and geometrically well defined, traverses the material to be studied. If this material shows internal electron density fluctuations, a scattered radiation around the beam transmitted is observed and it can be recorded on film or measured with a counter. The experimental technique is described and the results are reported. The study of the scattered radiation makes it possible to enumerate the cavities present and to define the dimensional characteristics. The results obtained on high purity Al irradiated by neutrons are in good agreement with those obtained by electron microscope. Small cavities difficult to observe or count with the electron microscope are observed with the small-angle scattering technique. Author (NSA)

N73-26544# California Univ., Livermore. Lawrence Livermore Lab.
DIFFUSIVITY AND SOLUBILITY OF NITROGEN IN MOLYBDENUM AND THE TRAPPING OF NITROGEN BY CARBON IN MOLYBDENUM Ph.D. Thesis
D. E. Weaver 25 Oct. 1972 84 p refs
(Contract W-7405-eng-48)
(UCRL-51182) Avail: NTIS

By employing ultrahigh vacuum techniques, the outgassing kinetics of nitrogen-saturated molybdenum were determined over a wide range of temperatures (1050 to 1925 C) and saturation pressure (0 to 769 torr). Both single and polycrystalline samples containing various amounts of carbon were used. It was found that the degassing rate is strictly diffusion-controlled under all conditions studied, thus allowing the diffusivity and the solubility of N in Mo to be calculated from the kinetic data. For high purity, zone-refined single crystals as well as decarburized polycrystalline Mo containing < 3 ppm C, the temperature dependence of the diffusivity of N is well represented. A model has been developed which explains the trapping effects caused by the second-phased carbide precipitates. This model assumes that the diffusing N is trapped by the bulk of the carbides, and that the N can diffuse in carbide. AUthor (NSA)

N73-26545# Tennessee Univ., Knoxville. Dept. of Chemical and Metallurgical Engineering.
STUDIES OF MICROSTRUCTURE-PROPERTY RELATIONSHIPS IN AUSTENITIC STAINLESS STEELS Technical Progress Report, 1 Feb. - 31 Dec. 1972
J. E. Spruiell 31 Dec. 1972 94 p refs
(Contract AT(40-1)-4044)
(ORO-4044-3) Avail: NTIS

Research on relations between microstructure and properties of austenitic stainless steels is summarized. Research results are presented on stability of type 316 stainless steel, grain refinement in austenitic stainless steel by pulse heating, precipitation reactions in types 316 and 321 stainless steel, and mechanical properties of type 316 stainless steel. NSA

N73-26546# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
EFFECTS OF ELECTRIC AND MAGNETIC FIELDS AND OTHER PHYSICAL PARAMETERS ON THE NUCLEATION, STRUCTURE, AND RESIDUAL PROPERTIES OF VAPOR-DEPOSITED METAL FILMS Final Report
L. E. Murr Apr. 1972 20 p refs
(Contract AT(04-3)-113; Proj. 22)
(USC-113-P-22-3; USCEE-412) Avail: NTIS

The effects of electric fields on the nucleation and growth of metallic thin films was studied, with particular emphasis on the low-melting point metals. No effects were observed with potential gradients up to 3 kV/cm in the plane of the substrate. Several prominent nucleation characteristics were observed which included vapor-liquid-solid (liquid nuclei supercooling) and vapor-solid nucleation characteristics which were observed to be a function of substrate temperature and film thickness evaporated at 0.000001 torr vacuum. Analyses were made of the effects of substrate temperature, evaporation rate, and film thickness on nucleation, film growth, and continuity. Results indicated the substrate temperature/melting temperature to be a critical factor in film growth, and to influence film continuity as a function of mean foil thickness, in addition to the surface energy of the nuclei, and the energy of the substrate/overgrowth interface. An apparatus was constructed for the application of a magnetic field in the plane of a substrate, having a linear field capability of 0 to 4 kgauss. NSA

N73-26547# Oak Ridge National Lab., Tenn.
EFFECT OF OXYGEN ON THE CORROSION OF NIOBIUM AND TANTALUM BY LIQUID LITHIUM
R. L. Klueh Mar. 1973 27 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4069) Avail: NTIS HC $3.50

The effect of oxygen on the corrosion of niobium and tantalum by liquid lithium at 600 C was studied with static capsules. An increase in the oxygen concentration of the lithium from 100 to 2000 ppm had no measurable effect on the dissolution of either refractory metal, a result that is contrary to the effect of similar oxygen concentrations in sodium and potassium. Exposure to lithium reduced the oxygen content of niobium and tantalum to less than or = 20 ppm regardless of the oxygen concentration of the lithium. These results agree with thermodynamic calculations that predict that the equilibrium distribution coefficient (i.e., the ratio of the oxygen concentration in the refractory metal to that in lithium) is very much less than unity. When the oxygen concentration of niobium and tantalum exceeded a threshold level, lithium (with no oxygen added) penetrated the refractory metal. Author (NSA)

N73-26548# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
INFLUENCE OF ENVIRONMENT ON THE APPEARANCE OF FATIGUE STRIATIONS ON VARIOUS ALLOYS
Georges Vidal and Gerard Lynas 1972 31 p refs In FRENCH; ENGLISH summary
(ONERA-NT-192) Avail: NTIS HC $3.75

An aluminum alloy AG5, a titanium T40, and a refractory alloy AT GS4 were fractured at room temperature, in some of the following gaseous environments: air, vacuum, hydrogen, argon, oxygen, carbon dioxide, and water vapor. The fracture surfaces were examined by the scanning electron microscope. AG5 alloy presented fatigue striations, irregular in dry gases and in vacuum but regular in humid gases and in water vapor when the total pressure exceeded 0.02 mb. Titanium T40 presented fatigue striations regular only in humid air, humid nitrogen, in dry hydrogen, and in water vapor when the total pressure exceeded 2 mb. At GS4 alloy presented fatigue striations regular in water vapor, humid air, and dry oxygen. It is concluded that gaseous environments influence the shapes of fatigue striations. ESRO

N73-26549# Royal Aircraft Establishment, Farnborough (England).
FRACTURE TOUGHNESS OF Al-Zn-Mg-Cu-Mn ALLOYS TO DTD 5024
C. J. Peel and P. J. E. Forsyth Nov. 1972 49 p refs
(RAE-TR-72173; BR32731) Avail: NTIS HC $4.50

Five Al-Zn-Mg-Cu alloy forgings were made with different compositions within the DTD 5024 specification limits to study the effect of composition variations on fracture toughness and tensile properties. Three forgings, of dimensions 165 mm by 150 mm by 100 mm, were prepared from melts of similar compositions except for the magnesium contents of 2.2%, 2.7% and 3.1%. Two further alloys, containing 5.3% and 6.2% zinc were cast and forged by the same procedure. The 0.14% zirconium was then added to the basic ternary alloy to study its grain refinement properties and its effects on the fracture toughness. It was found that reducing the magnesium content within the specification limits increased the fracture toughness with little effect on the proof strength. Reducing the zinc content also increased the fracture toughness but reduced the proof strength. The addition of 0.14% zirconium, which was outside the DTD 5024 specification, slightly reduced the fracture toughness of the ternary alloy but was found to give good grain refinement. A relationship was found between fracture toughness and true stress-true strain tensile test data. A conclusion from earlier work, that the presence of iron reduced the fracture toughness of the alloy, was considered. Author (ESRO)

N73-26550# Defence Research Information Centre, Orpington (England).
THE INFLUENCE OF ENVIRONMENT AND SURFACE CONDITION ON THE PROPERTIES OF MATERIALS. THE STRENGTH OF MEDIUM CARBON STEEL, CHROMED BY VARIOUS METHODS
B. Karpenko, N. S. Gorbunov et al Apr. 1973 8 p refs Transl. into ENGLISH from Fiz. Khim. Mekh. Materialov (Kiev), v. 4, no. 2, 1968 p 119-123
(DRIC-Trans-2156; BR-30436) Avail: NTIS HC $3.00

Equipment for chroming steel by gaseous and vapor phase methods, is described. The structures of diffusion layers formed by a variety of chroming methods (unplated, gas contact, gas non-contact, vacuum, and electrolytic methods) were studied. At equal thickness of diffusion layers, the greatest fatigue strength was observed in steel chromed by vapor phase and gaseous contact methods. Corrosion fatigue strength depends on the thickness and density of the diffusion layer; it has its greatest value in steels after gas contact chroming. ESRO

N73-26551# Defence Research Information Centre, Orpington (England).
THE ROLE OF COMPLEX FORMATION IN THE CORROSION AND PROTECTION OF METALS
N. G. Klyuchnikov, V. F. Uchenina et al Apr. 1973 9 p refs Transl. into ENGLISH from Uch. Zap. Mosk. Gos. Pedegog. Inst. (Moscow), 1969 p 214-221
(DRIC-Trans-3079; BR-30427) Avail: NTIS HC $3.00

The protective properties of organic complex-forming agents which produce insoluble chelate compounds with various metals were investigated. Reagents were taken which are used in analytical chemistry in the quantitative determination of metals: cupferron, 8-hydroxyquinoline, quinaldinic acid, anthanilic acid, dimethyl gloyxime, and alph-nitorso beta-naphtol. The effect of typical complex-forming agents was studied in connection with the following metals: Armco iron, copper, aluminum, zinc, nickel, and cobalt. It was found that the formation of insoluble complexes on the metal surface does not always ensure protection against corrosion. By X-ray and chemical analysis methods, the identity of phase films formed on metals in the presence of complexing agents and of complexes obtained as the result of exchange reactions in solution was confirmed. ESRO

N73-26552# Defence Research Information Centre, Orpington (England).
ON THE MECHANISM OF THE PROTECTIVE ACTION OF BENZOTRIAZOLE
C. A. Balezin, E. G. Zak et al Apr. 1973 11 p refs Transl. into ENGLISH from Uch. Zap. Mosk. Gos. Pedegog. Inst. (Moscow), 1969 p 262-271
(DRIC-Trans-3080; BR-30428) Avail: NTIS HC $3.00

The corrosion prevention mechanism of benzotriazole (BTA) inhibitors for protection of cadmium and zinc was investigated. The characteristic growth in the thickness of surface coatings on these metals in the presence of BTA, and their composition, were observed by using an optical polarization method, and an X-ray structural analysis technique. It was shown that BTA inhibits the growth of oxide films on zinc and cadmium in the early stages of oxidation of these metals. A theory is put forward that the protective properties of BTA with regard to zinc and cadmium are explained by the formation of very thin surface films consisting of compounds of BTA with metallic ions. ESRO

N73-26553# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
CUMULATIVE DAMAGE OF A HIGH STRENGTH ALUMINUM ALLOY (3.4364.7) UNDER LOADING SIMILAR TO NORMAL OPERATION [SCHADENSAKKUMULATION EINER HOCHFESTEN ALUMINIUMLEGIERUNG (3.4364.7) UNTER BETRIEBSAEHNLICHER BELASTUNG]
John H. Argyris, Werner Aicher, Juergen Ertelt, and Gerhard Kierner 1973 63 p refs In GERMAN
(Contract DFG-Ar-44/7)
(ISD-133) Avail: NTIS HC $5.25

Two standard mixed frequency distributions concerning cumulative damage were investigated for a high strength aluminium alloy 3.4364.7., in order to compare them with test results. The crack initiation load cycles were determined by microfractography for further cumulative damage investigations. The occurring distributions in the results of life tests give reasons for false interpretation. Two statistical methods and the related FORTRAN programs are indicated; these allow elimination of erroneous test points and testing of several lines with regard to parallelism, respectively, to determine the most probable inclination on double logarithmic scale. ESRO

N73-26554# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LAWS GOVERNING CRYSTALLIZATION OF INGOTS WITH CONTINUOUS CASTING IN AN ELECTROMAGNETIC CRYSTALLIZER
V. I. Dobatkin and G. Balakhontsev 5 Apr. 1973 23 p refs Transl. into ENGLISH from the monograph "Splavy Tsvetnykh Metallov" USSR, 1972 p 42-52
(AD-759230; FTD-MT-24-0150-73) Avail: NTIS CSCL 11/6

The report describes processes involved in casting aluminum in an electromagnetic crystallizer and recommends operating parameters for the operation. GRA

N73-26555# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
THE MAGNETIC SUSCEPTIBILITIES OF $NiCl_2.6H_2O$
A. I. Hamburger and S. A. Friedberg 10 Apr. 1973 22 p refs
(Contract N00014-67-A-0314-0006; NR Proj. 018-301)
(AD-759417; TR-9) Avail: NTIS CSCL 20/12

The magnetic susceptibilities of monoclinic single crystals of

the antiferromagnet NiCl2.6H2O(T(N)=5.34K) were measured between 1.2 and 20K. (Author Modified Abstract) GRA

N73-26556# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HIGH SPEED ROLLING OF IRON AND TITANIUM POWDERS

A. M. Musikhin, G. A. Vinogradov, R. K. Ognev, G. G. Kolomoets, and E. D. Ter-Pogosyan 22 Mar. 1973 14 p refs Transl. into ENGLISH from Sb. Tr. Met. Khim. Titana (USSR), v. 6, 1970 p 100-105

(AD-759241; FTD-HT-23-178-73) Avail: NTIS CSCL 11/6

The report describes the use of a continuous strip rolling mill, operated at a rolling rate in excess of normal, for the rolling of metallic powders. GRA

N73-26557# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.

INTERNAL OXIDATION OF DILUTE Cu-Ti ALLOYS

Susan Wood, Donald Adamonis, William A. Soffa, and Gerald H. Meier 1 Apr. 1973 39 p refs

(Contract N00014-67-A-0402-0008; NR Proj. 031-749)

(AD-759382; MME-IO-73-1) Avail: NTIS CSCL 11/6

The kinetics of internal oxidation of dilute Cu-Ti solid solutions, containing up to 1 wt % Ti, have been investigated over the temperature range 700 to 900C, and the oxide morphologies produced were studied by optical and electron metallography. (Author Modified Abstract) GRA

N73-26558# Army Foreign Science and Technology Center, Charlottesville, Va.

ADVANTAGES OF THE ELECTROSLAG MELTING METHOD IN CASTING OF ALUMINUM ALLOY INGOT

L. G. Berezin 7 Mar. 1973 5 p refs Transl. into ENGLISH from the monograph "Metalovedeniye Splavov i Legkikh Metallov" Moscow, 1970 p 98-100

(AD-759758; FSTC-HT-23-1447-72) Avail: NTIS CSCL 11/6

The report describes processes involved and the effectiveness of electroflux refining of aluminum alloys. GRA

N73-26559# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DISPERSED GRANULATION OF METALS AND ALLOYS

S. G. Glazunov, O. P. Solonina, and N. F. Chareshneva 18 Apr. 1973 21 p refs Transl. into ENGLISH from the monograph "Splavy Tsvetnykh Metallov" USSR, 1972 p 32-41

(AD-759625; FTD-MT-24-0149-73) Avail: NTIS CSCL 11/6

The possibility is shown of obtaining high-quality spherical granules from alloys on different bases and with different specific gravity. In the example of titanium alloys an essential increase in strength properties at room and elevated temperatures as a result of granulation is established. The manufacture of composite materials on a base of granulated titanium of the type alloy - alloy, reinforced and dispersion-strengthened is possible. The prospect is shown for the manufacture of the above-mentioned composite materials for the purpose of increasing the operating temperatures, strength properties, and creep resistance of titanium alloys. GRA

N73-26560# Defence Research Information Centre, Orpington (England).

AN EVALUATION OF THE PROPERTIES OF DOUBLE MELTED 18 PERCENT Ni Co Mo MARAGING STEEL

A. E. Longley 1972 88 p refs

(AD-759820; BR28509; S/T-Memo-3-72) Avail: NTIS CSCL 11/6

The evaluation of the 18% Ni Co Mo maraging steel has demonstrated that provided double vacuum melted stock is used the material possesses excellent static mechanical properties as either bar or forgings. The maintenance of high notched strength and good impact values over a wide temperature range makes the material attractive for structural applications, although the lower modulus of elasticity of maraging steel must be taken into account in design considerations. Author (GRA)

N73-26561# Army Materials and Mechanics Research Center, Watertown, Mass.

STRUCTURAL PROPERTIES OF DUAL HARDNESS STEEL ARMOR

Albert A. Anctil, Richard Chait, Charles H. Curll, and Eric B. Kula Feb. 1973 25 p refs

(AD-759506; AMMRC-TR-73-6) Avail: NTIS CSCL 19/4

Because of interest in the Aerial Reconnaissance System there has been increased emphasis on the load-carrying capabilities of dual hardness steel (DHS) armor material. This material is a composite consisting of a high-hardness, high-carbon frontal plate metallurgically bonded to a softer lower carbon steel backup. Since the concept of DHS used for both structural and armor purposes is new, relatively little information is available to designers on the structural properties after ballistic impact. In the present paper, four different lots of (DHS) having target hardness levels of Rc 60 for the frontal portion and Rc 50 for the backup are considered. One lot was produced by standard ausforming techniques while the other three were conventionally produced heat-treatable roll-bonded steels. Base-line mechanical property data are given. These include tensile, fatigue crack propagation, and S-N behavior. The effects of varying temperature and frequency on crack propagation rate are shown. Ballistically damaged specimens are used to provide information on residual strength and residual life. Author (GRA)

N73-26562# California Univ., Los Angeles. School of Engineering and Applied Science.

THE DETERMINATION OF THE RELATIONSHIP BETWEEN STRAIN AND MICROHARDNESS BY MEANS OF VISIOPLASTICITY

J. N. Robinson and A. H. Shabaik Feb. 1973 24 p refs

(Contract DAHC04-68-C-0008; DA Proj. 2o0-61102-B-32D)

(AD-759197; UCLA-ENG-7313; AROD-8016-9-MC) Avail: NTIS CSCL 11/6

The determination of strain values by means of microhardness measurements is a useful technique in that it can be used to measure plastic strains either on the surface or within the body of a specimen or structural component. A method is described whereby a calibration curve between strain and microhardness can be obtained by use of the visioplasticity technique. The curve thus obtained is valid for complex stress and strain states and for high strains. The microhardness was found to be a single valued function of the true effective strain independent of how this strain was produced. Agreement was found between the microhardness and values calculated from the flow stress. Author (GRA)

N73-26563# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

METALLURGICAL AND MECHANICAL TESTS OF MATERIALS Final Report

10 Jan. 1973 21 p refs Supersedes AD-717375

(AD-759225; TOP-3-2-806; AD-717375) Avail: NTIS CSCL 11/6

The report describes methods of evaluating the physical properties of components and causes of failures. It describes equipment required and procedures for chemical analysis (wet method, spectrographic and X-ray emission spectrographic analysis); macroscopic examination (gross structure and fracture area); microscopic examination; and mechanical testing including tension tests, hardness tests (Rockwell, Brinell, Tukon, scleroscope, and Vickers), notched-bar impact tests (Charpy and Izod), fracture toughness tests, and fatigue tests. Author (GRA)

N73-26564# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME WAYS OF INCREASING THE MECHANICAL PROPERTIES OF SEMIFINISHED PRODUCTS MADE FROM HEAT RESISTANT ALLOYS

A. F. Belov 1 May 1973 17 p refs Transl. into ENGLISH from the publ. "Splavy Tsvetnykh Metallov" USSR, 1972 p 17-23

(AF Proj. 60107)

(AD-760273; FTD-MT-24-148-73) Avail: NTIS CSCL 11/6

Methods are surveyed for improving the heat resistance of alloys for use in aircraft engines. Vacuum-arc melting, and electron beam furnace techniques are discussed. Comparisons of the mechanical properties of alloys obtained by these techniques with those obtained by traditional processes are included. Author

N73-26565# Clemson Univ., S.C. Coll. of Engineering.
OXIDE GROWTH RATES ON MAGNESIUM Technical Report, 13 Oct. 1971 - 13 Oct. 1972
James S. Wolf Apr. 1973 154 p refs
(Contract F29601-72-C-0012; AF Proj. 317J)
(AD-760176; AFWL-TR-73-2) Avail: NTIS CSCL 11/6

During the heating of metals with high-power-density lasers, the undesirable phenomenon of thermal runaway occurs which leads to the destruction of the workpiece. The objective of this research program has been to secure information which will provide a basis for understanding the processes involved in thermal runaway. This was done by studying various parameters of the high-temperature, magnesium-oxygen interaction using specimens which were heated by infrared radiation to temperatures approaching or exceeding the melting point of magnesium. Heating was performed in oxidizing atmospheres at controlled rates up to 115C per second. (Author Modified Abstract) GRA

N73-26566# General Electric Co., Schenectady, N.Y.
TECHNOLOGY DEVELOPMENT FOR TRANSITION METAL-RARE EARTH HIGH-PERFORMANCE MAGNETIC MATERIALS Semiannual Interim Technical Report, 1 Jul. - 31 Dec. 1972
Joseph J. Becker Apr. 1973 48 p refs
(Contract F33615-70-C-1626; ARPA Order 1617)
(AD-760178; SRD-73-059; AFML-TR-73-50; SATR-5) Avail: NTIS CSCL 11/6

The objective of this work is to develop the technology of high-performance transition metal-rare earth magnets for critical applications. High-performance permanent magnets are defined in this context as those having remanences greater than ten thousand gauss and permeabilities of very nearly unity throughout the second and into the third quadrants of their hysteresis loop. Such technology is to be developed through (1) studies of the origin of the intrinsic coercive force in high-anisotropy materials, (2) development of information on phase equilibria in these materials, and (3) identification and investigation of new materials. The progress that has been made during the period covered by this report is described under these three major headings. GRA

N73-26567# Army Materials and Mechanics Research Center, Watertown, Mass. Metals Research Div.
THE EFFECT OF HEAT TREATMENT ON THE MECHANICAL PROPERTIES OF THE ALLOY Ti-8Al-1Mo-1V
Paul J. Fopiano and Charles F. Hickey, Jr. Apr. 1973 19 p refs
(DA Proj. 1T0-62105-A-328)
(AD-760461; AMMRC-TR-73-17) Avail: NTIS CSCL 11/6

The effect of heat treatment on the mechanical properties of the alloy Ti-8Al-1Mo-1V (8-1-1) was investigated for solution temperatures from 1400 to 1900F. Significant increases in strength can be obtained by selected solution and aging heat treatments. A critical temperature range for this alloy is observed to be 1550 to 1700F where a yield strength minimum and ductility and toughness maximums were found. X-ray and replica electron microscopic studies were also conducted. A detailed discussion of the results and observations is contained in this report. Author (GRA)

N73-26568# George Washington Univ., Washington, D.C.
CRACK-INITIATION MECHANISMS
William A. Wood and Charles M. Gilmore Apr. 1973 21 p refs
(Contract N00014-67-A-0214-0011)
(AD-760007; TR-14) Avail: NTIS CSCL 11/6

Basic requirements are noted for initiating a crack in a solid. A brief outline is given of the arguments underlying current conventional dislocation theories. Finally attention is drawn to cases where these arguments can hardly hold and which seem to call for an alternative mechanism. One, a dynamic overload mechanism, is discussed and illustrated by scanning-electron micrographs. (Author Modified Abstract) GRA

N73-26569# Illinois Univ., Chicago. Dept. of Materials Engineering.
FAST FREEZING AS A METHOD FOR ALUMINUM ALLOY DEVELOPMENT Final Report, 10 Jul. 1970 - 31 Dec. 1972
W. Rostoker, R. Dudek, C. Freda, and R. Russell Wright-Patterson AFB, Ohio AFML Mar. 1973 38 p refs
(Contract F33615-70-C-1525; AF Proj. 7351)
(AD-759828; AFML-TR-73-36) Avail: NTIS CSCL 11/6

It is shown that the atomization process generates sufficiently high freezing rates to suppress within limits the primary crystallization of intermetallic compounds and the secondary crystallization of eutectic. The resultant structures are probably supersaturated solid solutions. Thus for example alloying aluminum with as much as 5 % Mn and 3 % Cr, respectively, is practical. It is shown that Al- Mn- Cu and Al- Mn- Cr- Mg- Zn alloys produced from consolidated powder can generate high tensile yield strengths and hardnesses which resist softening at temperatures as high as 350 C. Some alloys show good hot yield strengths. Preliminary tests indicate that these alloys are not susceptible to stress-corrossion cracking at stresses of yield strength magnitude. Author (GRA)

N73-26570# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
INTERNAL FRICTION DURING REPEATED DISCONTINUOUS YIELDING OF METALS
J. Baruch and Sol R. Bodner Feb. 1973 24 p refs
(Contract F44620-72-C-0004; AF Proj. 9782)
(AD-760145; MED-38; AFOSR-73-0739TR; SR-2) Avail: NTIS CSCL 11/6

Internal friction measurements were made on three FCC alloys, alpha-brass and 2024 and 6063 aluminum, coincident with repeated discontinuous yielding of the specimens (Portevin-Le Chatelier effect). A torsional pendulum arrangement was used to obtain low amplitude, low frequency (10-30 Hz) damping values while the specimens were plastically deforming under dead weight loading. The internal friction was found to be amplitude independent and to vary linearly with strain rate over the range experienced by the specimens. The linear dependence of internal friction on strain rate was obtained during the full course of a test and particularly during each individual strain jump at constant stress. These results indicate that the mobile dislocation density is primarily responsible for internal friction in the low amplitude, low frequency range. Author (GRA)

N73-26571# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRUCTURE AND PROPERTIES OF HIGH-MODULUS ALLOYS OF BERYLLIUM WITH ALUMINUM
I. N. Fridlyander, K. P. Yatsenko, G. A. Nekrasova, V. S. Sandler, and Z. G. Semenova 6 Apr. 1973 14 p refs Transl. into ENGLISH from the publ. "Splavy Tsvetnykh Metallov" USSR, 1972 p 230-234
(AD-759876; FTD-HT-23-159-73) Avail: NTIS CSCL 11/6

Alloys on an aluminum-beryllium base with magnesium possess a valuable complex of physical and mechanical properties, of which the most important are their lightness and high modulus of elasticity, approaching that of pure beryllium. At the same time the number of the negative properties which hamper and limit the use of beryllium in construction are absent in the alloys. GRA

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-26572* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTUMESCENT COMPOSITION, FOAMED PRODUCT PREPARED THEREWITH, AND PROCESS FOR MAKING SAME Patent
Salvatore L. Riccitiello and John A. Parker, inventors (to NASA) Issued 1 May 1973 3 p Filed 16 May 1971 Supersedes N71-34501 (09 - 21, p 3443)
(NASA-Case-ARC-10304-1; US-Patent-3,730,891; US-Patent-Appl-SN-140946; US-Patent-Class-252-8.1) Avail: US Patent Office CSCL 11D

An intumescent composition and the foamed product prepared by heating are discussed wherein the composition comprises the reaction product of para-benzoquinone dioxime and a concentrated mineral acid such as sulfuric acid, phosphoric acid, and polyphosphoric acid. The composition is useful as an intumescent agent either by itself or when combined with other materials. A fire-resistant and heat-insulating composition is provided by heating the intumescent composition above its intumescent temperature.
Official Gazette of the U.S. Patent Office

N73-26573# National Bureau of Standards, Washington, D.C. Office of Standard Reference Materials.
STANDARD REFERENCE MATERIALS, 1973 CATALOG
Apr. 1973 96 p refs Mostly in ENGLISH; partly in FRENCH, GERMAN, and SPANISH Supersedes NBS-SP-260, Jul. 1970 Ed.
(NBS-SP-260; LC-72-600291) Avail: SOD HC $1.25 Domestic Postpaid or $1.00 GPO Bookstore as C13.10:260-1973
Listed and described are the Standard Reference Materials (SRM's), Research Materials (RM's), and General Materials (GM's) currently distributed by the National Bureau of Standards, as well as many of the materials currently in preparation. SRM's are used to calibrate measurement systems and to provide a central basis for uniformity and accuracy of measurement. The RM's are not certified, but are issued to meet the needs of scientists engaged in materials research. The GM's are standardized by some agency other than NBS. Announcements of new and renewal SRM's, RM's, and GM's are made in the semiannual supplements to this catalog, SRM price and availability list, the NBS Technical News Bulletin, and in scientific and trade journals.
Author

N73-26574# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
INVESTIGATION OF THE INFLUENCE OF OUTDOOR WEATHERING ON THE MECHANICAL PROPERTIES AND THE QUALITY OF APPEARANCE OF SEVERAL GLASS-CLOTH REINFORCED THERMOSETTING RESIN LAMINATES Interim Report
R. Scheltes 6 Mar. 1973 69 p
(FOK-R-1627) Avail: NTIS HC $5.50
Changes in the flexural strength properties and appearance of the surface of solid polyester and epoxy glass cloth reinforced laminates are determined, by means of outdoor weathering. As parameters, several fabrication methods were introduced. Test results after 3 years outdoor weathering are also presented.
Author

N73-26575# Royal Aircraft Establishment, Farnborough (England).
THE PROPERTIES OF GLASS-FIBRE REINFORCED PLASTICS STRENGTHENED WITH HIGH-MODULUS FIBRES
A. M. Skudra, E. Z. Plume, G. M. Gunyaev, V. A. Yartsev, and N. A. Belyaeva Jan. 1973 13 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR. (Riga), v. 1, 1972 p 68-74
(RAE-Lib-Trans-1687; BR33272) Avail: NTIS HC $3.00
Consideration is given to the question of strengthening unidirectionally glass-fiber reinforced plastics by means of boron and carbon fibers. Curves are given for static fatigue, for Poisson's ratio and elastic modulus in relation to the volume fraction of glass and high-modulus fibers. Theoretical relationships and experimental data are compared.
Author

N73-26576# Royal Aircraft Establishment, Farnborough (England).
THE SHRINKAGE OF EPOXY BONDING AGENTS IN THE CURING PROCESS
V. V. Bolotin and K.S. Bolotina Dec. 1972 10 p refs Transl. into ENGLISH from Mekh. Polim. (Riga), v. 192, no. 1, 1972 p 178-181
(RAE-Lib-Trans-1686; BR32893) Avail: NTIS HC $3.00
The results of measurements of the density of two types of epoxy bonding agents in the process of hardening (curing) from the initial liquid state to the final state at room temperature are reported. The part played by heat shrinkage in overall shinkage deformation is evaluated. It is shown that the shrinkage factor in relation to the state with the least density exceeds the values cited in the literature.
Author

N73-26577# Royal Aircraft Establishment, Farnborough (England).
DYNAMIC SPRING ANALYSIS (DSA)
Shunji Naganuma (Hokkai Seikan (Can) Co., Ltd.), Tetsuo Sakurai (Hokkai Seikan (Can) Co., Ltd.), Yuzo Takahashi (Hokkai Seikan (Can) Co., Ltd.), and Seichi Takahashi (Dainippon Ink and Chemicals, Inc.) Feb. 1973 14 p refs Transl. into ENGLISH from Chem. of High Polymers, v. 29, no. 322, 1972 p 105-109
(RAE-Lib-Trans-1698; BR33630) Avail: NTIS HC $3.00
For measuring the hardening reaction of polymeric materials in a solid or liquid state, an analytical method, which is called a dynamic spring analysis (DSA), was proposed. In DSA, the hardening reaction of a sample is measured from variation in the dynamic viscoelastic properties of the sample by applying a vertical vibration to a small spiral spring about 10 mm in length, which is used for holding the sample. It is possible to measure by DSA not only the hardening reaction but also the dynamic viscoelasticity spectra of samples in a solid or liquid state and their variation accompanying a phase transition (for instance, due to the evaporation of a solvent or to the fusion of the sample). The method used for measuring the variation in dynamic viscoelastic properties (spectra) is analogous to a method which has been proposed by Gillham. It was found that the sensitivity in this method is from 10 to 100 times higher than that in torsional braid analysis (TBA).
Author

N73-26578# National Bureau of Standards, Washington, D.C.
A STUDY OF THE DECOMPOSITION PRODUCTS OF POLYURETHANE FOAM RELATED TO AIRCRAFT CABIN FLASH FIRES Final Report, Mar. 1971 - Jun. 1972
Maya Paabo and J. J. Comeford Jul. 1973 39 p refs
(FAA Order FA67-NF-AP-21)
(FAA-NA-73-69; FAA-RD-73-46) Avail: NTIS HC $4.25
A laboratory model of a flash fire cell using a high voltage arc as an ignition source was assembled and tested. The cell is designed to pyrolyze the sample in air while measuring the time of onset of a flash fire and simultaneously allowing withdrawal of gas samples for analysis. Some of the low molecular weight products produced from the pyrolysis of flexible polyether type urethane foams were identified. The flash fire cell was used to compare the flash fire potential of polymers of potential interest to the aircraft industry. Studies of the role of smoke in flash fire produced in the pyrolysis of flexible urethanes were undertaken. Flash fires in the cell were recorded on motion picture film.
Author

N73-26579*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT-SERVICE EVALUATION OF COMPOSITE STRUCTURAL COMPONENTS
H. Benson Dexter Washington Jul. 1973 38 p refs
(NASA-TM-X-2761; L-8474) Avail: NTIS HC $3.00 CSCL 11D
A review of programs aimed at flight-service evaluation of composite materials in various applications is presented. These flight-service programs are expected to continue for up to 5 years and include selective reinforcement of an airplane center wing box a helicopter tail cone, and composite replacements for commercial aircraft spoilers and fairings. These longtime flight-service programs will help provide the necessary information required by commercial airlines to commit advanced composites to aircraft structures with confidence. Results of these programs will provide information concerning the stability of composite materials when subjected to various flight environments.
Author

N73-26580*# Bausch and Lomb, Inc., Rochester, N.Y.
RESARCH INVESTIGATION ON DENSE SCINTILLATION GLASS FOR USE IN TOTAL ABSORPTION NUCLEAR CASCADE DETECTORS Final Report
J. R. Hensler Jun. 1973 10 p
(Contract NAS9-11356)
(NASA-CR-133960) Avail: NTIS HC $3.00 CSCL 11B
Three approaches to the development of a high density

scintillation glass were investigated: They include the increase of density of glass systems containing cerium - the only systems which were known to show scintillation, the testing of a novel silicate glass system containing significant concentrations of silver produced by ion exchange and never tested previously, and the hot pressing of a diphasic compact of low density scintillation glass with high density passive glass. In first two cases, while ultraviolet excited fluorescence was maintained in the glasses showing high density, scintillation response to high energy particles was not retained in the case of the cerium containing glasses or developed in the case of the silver containing glasses. In the case of the compacts, the extremely long path length caused by the multiple internal reflections which occur in such a body resulted in attenuation even with glasses of high specific transmission. It is not clear why the scintillation efficiency is not maintained in the higher density cerium containing glasses.
Author

N73-26581*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT AND EVALUATION OF POLYIMIDE LAMINATES FOR PRINTED WIRING BOARD APPLICATIONS
William J. Patterson 12 Jun. 1973 67 p refs
(NASA-TM-X-64760) Avail: NTIS CSCL 11D

A developmental and evaluation program on polyimide laminates as printed wiring boards is described. The development of an experimental polyimide with low linear coefficient of thermal expansion normal to the plane of the board is discussed, and its properties are evaluated along with two commercial polyimide printed wiring boards for comparison with the type G-10 epoxy board. Thermal cycling data indicate an urgent need for effectively controlling the expansion normal to the plane of the board in order to minimize solder joint damage. Author

N73-26582# Thiokol Chemical Corp., Huntsville, Ala.
DEVELOPMENT OF AN M-S-A TEST STANDARD IN THE SUB-MICRON RANGE
William H. Oetjen Aug. 1972 31 p refs Presented at the 3d JANNAF Propellant Characterization Working Group Meeting, Monterey, Calif., 9 Aug. 1972
Avail: NTIS HC $3.75

Data were submitted on the aluminum oxide (Al2O3) sample. Four M-S-A analyses were run on each set. The parameters statistically evaluated for material characterization were the 16%, 50% and 84% points on the particle size distribution curves and the specific surface area, calculated from the distribution curves. In addition, a combined average curve with 99% confidence limits (C.L.) as an envelope was generated and is presented in this paper as a plastic overlay. This curve is designed to serve as a convenient reference for data comparison when the Al2O3 standard is analyzed. Author

N73-26583*# General Dynamics/Convair, San Diego, Calif.
INVESTIGATION INTO THE HIGH-TEMPERATURE STRENGTH DEGRADATION OF FIBER REINFORCED RESIN COMPOSITE DURING AMBIENT AGING Final Report, Jul. 1971 - Jun. 1973
J. Hertz Jun. 1973 175 p refs
(Contract NAS8-27435)
(NASA-CR-124290; GDCA-DBG73-005) Avail: NTIS HC $10.75 CSCL 11D

An investigation was conducted to determine the cause for the reduction in high temperature strength properties of graphite- and boron-reinforced epoxy composites following aging in room temperature environments. The types of resins tested are identified. The test procedures are explained. Tables of data and graphs are provided to show the effects on various materials. Author

N73-26584# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
APPLICATION OF INORGANIC EXCHANGERS TO RADIOCHEMICAL SEPARATIONS ON NEUTRON ACTIVATED HIGH PURITY MATERIALS
J. Cuypers, F. Girardi, and F. Mousty 1972 12 p refs Presented at Internatl. Colloq. on the Activation Anal. of Micro-Quantities of Elements in Very High Purity Inorg. and Org. Substances and in Biol. Media, Saclay, France, 2-6 Oct. 1972
(Conf-721069-42) Avail: AEC Depository Libraries

The application of inorganic exchangers to the destructive analysis of high purity materials, particularly for the systematic determination of many elements, is studied. Recent improvements in the methodology for the mathematical assessment of radiochemical separation schemes by means of inorganic exchangers are briefly outlined. Separation schemes for the determination of impurities in high-purity aluminum and zinc are presented. Results are given for several zinc samples obtained by successive purifications, showing variation trends for the distribution of various impurities. Results obtained in the application to a zinc sample used as standard reference material are also presented.
Author (NSA)

N73-26585# Minnesota Mining and Mfg. Co., St. Paul. Electrical Products Group.
THERMOELECTRIC MATERIALS EVALUATION PROGRAM Quarterly Technical Task Report No. 39
E. F. Hampl, Jr. 20 Oct. 1972 81 p refs
(Contract AT(29-2)-2473)
(MMM-2473-342) Avail: NTIS HC $6.25

The program for evaluating thermoelectric materials involves three tasks; N-type material development, P-type TPM-217 material characterization, and couple development. Work in progress in each of these tasks is described. NSA

N73-26586# Battelle-Northwest, Richland, Wash. Pacific Northwest Labs.
CONSTANT-STRESS IRRADIATION CREEP EXPERIMENTS ON GRAPHITE
W. J. Gray 1972 5 p refs Presented at Internatl. Carbon Conf., Baden-Baden, West Ger., 26 Jun. 1972 Sponsored by AEC
(BNWL-SA-4199; Conf-720609-8) Avail: NTIS HC $3.00

Constant-stress irradiation-creep capsules were developed that permit application of a load to a stack of several graphite samples by a single pneumatic bellows. One tensile-creep capsule is operated at 800 C and two compressive-creep capsules operated at 550 and 800 C, respectively. Three types of graphite were irradiated under stresses up to 3000 psi. No tensile-creep data were available. Data for the compressive-creep experiments following the third irradiation period with total fluences up to about 1.0 x 10 to the 22nd power n/sq cm indicate that, at 550 C, the creep was still essentially linear. At 800 C, however, the creep coefficient changed markedly at fluences above 6 x 10 to the 21st power n/sq cm. For one graphite, the creep coefficient increased, while for the other two graphites, it decreased and even became negative in some cases. Author (NSA)

N73-26587# Royal Aircraft Establishment, Farnborough (England).
A TEST SPECIMEN FOR THE COMPRESSIVE STRENGTH AND MODULUS OF UNIDIRECTIONAL CARBON FIBRE REINFORCED PLASTIC LAMINATES
D. Purslow and T. A. Collings Jun. 1972 25 p refs
(RAE-TR-72096) Avail: NTIS HC $3.25

The design and evaluation of flat specimens for the determination of the compressive strength and modulus of unidirectional carbon fiber reinforced plastics laminated from resin pre-impregnated sheets are described. Tests indicate that the values obtained reflect reliably the true properties of the materials. Tests conducted to evaluate the strength specimen also indicated that composite compressive strength increases with composite shear strength, suggesting that compressive failure follows from local failure of the resin/fiber band. Author (ESRO)

N73-26588# Royal Aircraft Establishment, Farnborough (England).
COMPOSITE RUBBER NETWORKS. PART 1. VULCANISATES BASED ON NITRILE AND SILICONE RUBBERS
D. K. Thomas and J. Day Oct. 1972 23 p ref
(RAE-TR-72184; BR32114) Avail: NTIS HC $3.25

The concept of composite rubber networks, i.e. rubbers produced by the covulcanization of two specialty rubbers, is examined as a means of producing vulcanizates with a balance of physico-chemical properties unlike that of any currently available specialty rubber. Using nitrile and silicone rubbers, it is shown that materials properties can be closely controlled to give rubbers

of considerable interest for application in the temperature range from -40 to +160 C. Author (ESRO)

N73-26589# Oxford Univ. (England). Dept. of Engineering Science.
VISCOELASTIC PROPERTIES OF SILICA FIBRE REINFORCED EPOXIDES AND A THEORY OF FRACTURE OF FIBRE REINFORCED VISCOELASTIC MATERIALS
R. G. C. Arridge London Min. of Defence Jan. 1972 80 p refs
(Contract MIN-TEC-PD-57-021)
(D-MAT-178) Avail: NTIS HC $6.00

The measurement of shear modulus and damping of epoxy resin samples unidirectionally reinforced with silica fibers is described. The measurements were performed over a temperature range, including the glass-rubber transition of the resin on samples cut with fibers at various angles to the specimen axis. Fiber concentrations up to 74 percent used. The results were compared with theoretical values derived from three different theories and fair agreement found for the glassy state of the resin. Anomalies were found in the rubber modulus and in the shape and position of the main absorption peak for the resin. The causes of these anomalies are discussed and satisfactory explanations put forward. A theory is presented for fracture of unidirectional fiber reinforced materials in which the rate at which elastic energy, released by fiber breakage, can be absorbed, is calculated. Analogies of fiber reinforcement theory and chain fracture theories in polymers are discussed. Author (ESRO)

N73-26590# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
PROOF TESTING OF CERAMIC MATERIALS - AN ANALYTICAL BASIS FOR FAILURE PREDICTION Interim Report
A. G. Evans and S. M. Wiederhorn Mar. 1973 37 p refs
(NR Proj. 032-517)
(AD-759373; NBSIR-73-147) Avail: NTIS CSCL 11/2

An analysis is presented which permits the accurate prediction of component lifetimes after proof testing. The analysis applies to crack propagation controlled fracture but can be used as a conservative prediction when crack initiation is predominant. The analytical predictions are confirmed in a series of time-to-failure measurements. Author (GRA)

N73-26591# Naval Ordnance Lab., White Oak, Md.
THE FREEZING OF CRYSTALLINE POLYMERS AS EVIDENCED BY COMPRESSIBILITY MEASUREMENTS
R. W. Warfield 23 Feb. 1973 23 p refs
(AD-759007; NOLTR-73-23) Avail: NTIS CSCL 07/4

The freezing points for a series of semicrystalline and crystalline polymers have been determined as functions of pressure and temperature. It is shown that with increasing temperature a greater pressure must be applied to induce freezing. It was also found that many polymers exhibit a small amount of supercooling. It has been found that crystalline polymers exhibit maximum temperatures above which it is impossible to induce crystallization regardless of the applied pressure. This maximum temperature is discussed in relation to the possible existence of a critical temperature for a polymer. Combining this new information on the freezing of polymers with previously known relations, it is now possible to give a more extended relationship for the various thermal transitions in a polymer. Author (GRA)

N73-26592# Georgia Inst. of Tech., Atlanta. School of Ceramic Engineering.
MELT-GROWN OXIDE-METAL COMPOSITES Semiannual Report, 10 Jun. - 9 Dec. 1972
Alan T. Chapman, James F. Benzel, J. K. Cochran, Robert K. Feeney, and G. W. Long Jan. 1973 114 p refs
(Contract DAAH01-71-C-1046; ARPA Order 1637)
(AD-759507; E18-604-5; SAR-5) Avail: NTIS CSCL 11/4

This research is designed to develop melt-grown oxide-metal composite structures for high field electron emission testing. A number of refractory oxide-metal mixtures (i.e. UO2-W, stabilized ZrO2 and HfO2-W, UO2-Ta, and the rare earth oxides of Gd2O3, Nd2O3 and La2O3-Mo and W) have been successfully induction melted and unidirectionally solidified to form aligned metallic fibers embedded in the oxide matrix. The system CeO2-Mo was added to this list this report period. The chemical etching behavior of UO2-W and CeO2 doped Gd2O3-Mo samples was extensively studied to establish conditions for forming a variety of desirable emitter configurations. Experimental electron emission testing has progressed through the use of better samples and improved etching and brazing procedures to the point where bulk emission currents of several hundred mA/sq cm can be routinely obtained. A three-dimensional numerical approximation is being used to theoretically analyze the field emission performance of various pin array geometries. (Author Modified Abstract) GRA

N73-26593# Princeton Univ., N.J. Dept. of Chemical Engineering.
REVIEW: TORSIONAL BRAID ANALYSIS OF POLYMERS
John K. Gillham Apr. 1973 42 p refs
(Contract N00014-67-A-0151-0024; NR Proj. 356-504)
(AD-759412; TR-16) Avail: NTIS CSCL 11/9

A review of the present status of Torsional Braid Analysis (TBA) includes discussion of instrumentation, specimen preparation, theory, and data reduction. The obtained thermomechanical spectra (about 1 cps) are discussed in terms of advantages which result from the use of small specimens. Applications include structure-property relationships, kinetics of crosslinking, and optimization of thermomechanical behavior in reactive systems. Author (GRA)

N73-26594# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
STRENGTH OF MOLDED DISCONTINUOUS FIBER COMPOSITES Technical Report, Jul. 1971 - Apr. 1972
K. L. Jerina and J. C. Halpin Oct. 1972 47 p refs
(AF Proj. 7342)
(AD-759827; AFML-TR-72-148) Avail: NTIS CSCL 11/4

The strength of randomly oriented short fiber composites will be modeled by a quasi-isotropic laminate. Lamination theory and a failure criterion will be used to approximate the stress strain response of a composite as it is loaded to failure. Experimental data will be presented in light of the failure tensor and maximum strain failure criteria. An invariant method of determining the interaction term of the failure tensor is investigated and evaluated with respect to experimental data. The laminate analogy for strength is also applied to a flow molded or extruded short fiber composite with a known fiber orientation distribution. Author (GRA)

N73-26595# Army Weapons Command, Rock Island, Ill. Weapons Lab.
SURFACE POTENTIAL AND WEAR MEASUREMENTS ON SELECTED CARBAMATES, AMINES, AND PHOSPHOROTHIOATES Final Technical Report
Joseph M. Bish Feb. 1973 19 p refs
(DA Proj. 1T0-61102-B-13A)
(AD-759126; SWERR-TR-73-3) Avail: NTIS CSCL 11/8

Measurements of surface potential, wear, and extreme pressure were completed for the homologous series of thiocarbamates, amines, and phosphorothioates. The surface potential measurements were made by the vibrating condenser method; wear was determined by the Four-Ball Wear Tester; and extreme pressure (EP) properties were determined by the Four-Ball EP Tester. Surface potential measurements conducted on 1 percent (by weight) solutions of zinc, lead, cadmium, and antimony diamyl-dithiocarbamates showed small differences in potential between the metal salts. The homologous series of amines showed very little difference in potential. Similar results were obtained for the homologous series of phosphorothioates. This indicates that the functional groups have a greater influence on surface potential than the alkyl groups within each homologous series. Zinc and antimony diamyldithiocarbamate gave the greatest improvement in wear. Thiocarbamates had superior extreme pressure properties. Author (GRA)

N73-26596# Gillette Research Inst., Inc., Rockville, Md.
NOMEX ULTRAVIOLET INHIBITORS Final Technical Report, Apr. 1970 - Sep. 1972
John F. Krasny and Anthony M. Schwartz Dec. 1972 38 p refs
(Contract F33657-70-C-0858)
(AD-759217; ASD-TR-72-104) Avail: NTIS CSCL 11/9

An investigation has been made of several systems intended to improve the resistance of Nomex fabric and webbing to actinic degradation. All of these consisted in applying to the Nomex a material that absorbs actinic radiation in the range 360 - 390 nm, which is known to be the wavelength involved in the photochemical degradation. Several materials are available that meet this primary requirement, but relatively few meet the added requirements of stability, safety in application and use, and lack of undesirable effects on the fabric. A major problem proved to be the durable and satisfactory bonding of the protective material to the Nomex. Best results were obtained by applying a pigment that was opaque to the harmful radiation (carbon-black) in a lacquer type polymeric tie-coat or binder. A vinyl resin was used as the major ingredient of the tie-coat. As a stipulated part of this investigation a complete survey was made of the technical literature relating to actinic degradation of polyamides. This is included as an appendix. Author (GRA)

N73-26597# Arizona Univ., Tucson.
CONDUCTANCE OF QUATERNARY AMMONIUM SALT DISPERSIONS IN POLYMERIC FILMS
Henry Freiser and Gary Carmack 1 Mar. 1973 13 p refs
(Contract N00014-67-A-0209-0017; NR Proj. 356-532)
(AD-759073; TR-1) Avail: NTIS CSCL 11/9

Solutions of quaternary ammonium salts in polymeric materials exhibit unusually high temperature coefficients of electrical conductivity. Experiments are described which indicate that conduction might be produced through a combination of electronic and ionic mechanisms. The materials studied show promise as throw-away thermistors. The results shed some light on the mode of behavior of the recently developed coated wire ion selective electrodes. Author (GRA)

N73-26598# Whittaker Corp., San Diego, Calif. Research and Development Div.
HIGH TEMPERATURE RESIN DEVELOPMENT Final Report, 29 Jun. 1972 - 28 Feb. 1973
Richard R. Rafter and Chadwick B. Delano Apr. 1973 35 p refs
(Contract DAAG46-72-C-0250; DA Proj. 1W0-62113-A-661)
(AD-759963; AMMRC-CTR-73-14) Avail: NTIS CSCL 11/4

Four existing polymers (PQ, PPQ, PBI, and phenolic) were fabricated into carbon composites and preliminary screening was initiated, using test methods responsive to ABM requirements. Flexural testing on these organic polymeric systems at 1400F were performed. All of the heterocyclic systems exhibited softening behavior at this temperature, with an attendant recovery in flexural modulus, due to pyrolysis of the matrix during testing. Resin optimization on the PPQ system involved crosslinking the resin system by a designed trifunctional cure. Research efforts directed toward the synthesis of a novel tris-benzil based on the thermally- and oxidatively-stable triazine ring nucleus is described. (Author Modified Abstract) GRA

N73-26599# Alabama Univ., Huntsville.
STABILIZATION OF CURE RATES OF DIISOCYANATES WITH HYDROXY-TERMINATED POLYBUTADIENE BINDERS Final Technical Report, Dec. 1971 - Mar. 1973
Samuel P. McManus, Harold S. Bruner, and H. Dwain Coble Apr. 1973 31 p refs
(Contract DAAH01-72-C-0662)
(AD-759960; UAH-RR-140) Avail: NTIS CSCL 11/10

The purpose of the study was to define the catalytic effect of various propellant ingredients or potential additives on the rate of reaction of a model alcohol-isocyanate reaction. The object was to define those species and factors which contribute to a short pot-life in hydroxy-terminated polybutadiene (HTPB) bound propellants and to test various means of sequestering these species or, alternatively, of removing them. Studies of the effects of various catalysts on the reaction between alkyl isocyanates and alcohols have been carried out. In general, substances soluble in the reactants are more effective catalysts with organoiron derivatives being the most effective of those studied. The reaction was found to be light-assisted and ferrocene was shown to be a catalyst both in the presence of and in the absence of light. Ferrocene and its derivatives are degraded by light in the presence of air and by ammonium perchlorate. Author (GRA)

N73-26600# British Columbia Univ., Vancouver. Dept. of Electrical Engineering.
PLASMA ANODIZATION Final Report, 21 Jun. 1971 - 20 Jun. 1972
David L. Pulfrey, Lawrence Yound, and Graham Olive Nov. 1972 50 p refs
(Contract F33615-71-C-1886)
(AD-760171; AFAL-TR-72-362) Avail: NTIS CSCL 11/3

The process of plasma anodization has been investigated using two systems. The first was a cold cathode dc discharge system (replacing apparatus described in our earlier reports) with automated ellipsometry to continuously follow the growth of the oxide. The second system employed an RF discharge with growth of the oxide being followed by monitoring the intensity reflectivity of s-light from a He/Ne laser. Experiments are described which indicate that negative oxygen ions that form the plasma are not directly involved in the growth of oxides on tantalum in a dc discharge. Also reported are data on the thickness-and temperature-dependence of the relation between oxide field and oxide growth rate for the case of Si anodization in an RF dicharge. Author (GRA)

N73-26601# Auburn Univ., Ala. Dept. of Mechanical Engineering.
SCATTERED LIGHT PHOTOELASTIC ANALYSIS OF EPOXY GLASS STRUCTURES
W. F. Swinson, W. F. Ranson, and Judson R. Griffin 10 Dec. 1972 79 p refs
(Contract DAAH01-71-C-0976)
(AD-759900; RL-TR-72-16) Avail: NTIS CSCL 11/4

An experimental model for predicting the stress distribution in symmetric angle ply composites was developed. This model was developed in order to determine the three dimensional effects for uniform axial loading of a tensile specimen. Scattered light photoelasticity was used as the experimental technique to determine the stress distributions. The particular example was a two layer laminate with a bias angle 0 = plus or minus 15 deg. However, techniques used in casting a two layer model can easily be extended to composites made of several layers. A numerical integration procedure was developed which would be applied to mixed boundary value problems. This procedure was used in the solution of the symmetric angle ply composite. (Author Modified Abstract) GRA

N73-26602# Princeton Univ., N.J. Dept. of Chemical Engineering.
EPOXY THERMOSETTING SYSTEMS: DYNAMIC MECHANICAL ANALYSIS OF THE REACTIONS OF AROMATIC DIAMINES WITH THE DIGLYCIDYL ETHER OF BISPHENAL A
J. K. Gillham and P. G. Babayevsky Apr. 1973 40 p refs
(Contract N00014-67-A-0151-0024; NR Proj. 356-504)
(AD-759995; TR-17) Avail: NTIS CSCL 11/9

Dynamic mechanical behavior during the reactions of four aromatic diamines (m-phenylenediamine, 4,4:-diaminodiphenylmethane, 4,4:-diaminodiphenyl sulfone, and benzidine) with the diglycidyl ether of bisphenol A was studied by torsional braid analysis under isothermal conditions. Depending on the cure temperature, three types of behavior were observed: (I) below T(gg) (the glass transition temperature of the reactive systems at the gel point); (II) between T(gg) and T(g infinity) (the glass transition temperature of the ultimately cured polymers); (III) above T(g infinity). Overall activation energies and apparent overall rate constants of the cure reactions based on third-order overall kinetics were determined before gelation, after gelation but before vitrification, and after vitrification. The influence of cure temperature and structure of the diamines on the kinetic parameters is discussed. (Author Modified Abstract) GRA

N73-26603# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
THE USE OF EXPERIMENTAL DESIGN AND COMPUTERIZED DATA ANALYSIS IN ELASTOMER DEVELOPMENT STUDIES Interim Report, 1 Dec. 1971 - 1 Aug. 1972
Paul E. Gatza and Robert C. McMillan Feb. 1973 31 p
(DA Proj. 1E6-63715-D-091)
(AD-759902; USAMERDC-2051) Avail: NTIS CSCL 11/10

The rapidly expanding field of computerized data reduction has produced many special purpose programs and routines designed to perform recurring calculations involving complex mathematical techniques such as variance and least squares regression analysis. These basic techniques, when combined with the theory of experimental design, can be employed by the rubber compounder and can result in the derivation of extensive meaningful data from a minimum amount of actual compounding and physical testing. The report describes a computer program designed specifically to: (a) select the proper experimental design for any matrix of up to five compounding variables, each at up to five levels, according to the principle of defining contrasts; (b) analyze physical test data according to the method of least squares regression; (c) determine the relative significance of compounding factors through use of the F Ratio Tests; (d) predict the properties of all untested compounds derived from the design matrix; and (e) scan within the limits of the compounding variables to predict the formulation and physical properties of compounds conforming to a given set of specification or performance requirements. Author (GRA)

N73-26604# Naval Ordnance Lab., White Oak, Md.
HYDROLYTIC STABILITY OF TWO NEW POLYURETHANE POTTING COMPOUNDS .
Richard D. Ezell and Joseph M. Augl 4 Apr. 1973 16 p refs
(AD-759972; NOLTR-73-42) Avail: NTIS CSCL 11/9

Two new potting compounds have been prepared in a joint effort by the Hystl Company and the Naval Ordnance Laboratory. These compounds have much greater hydrolytic stability than do some potting compounds previously used in Navy aircraft. The report summarizes work which shows the hydrolytic stability of the compounds. GRA

N73-26605# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
THE EFFECTS OF HIGH INTENSITY ELECTRICAL CURRENTS ON ADVANCED COMPOSITES Final Report
J. L. Perry, R. L. Miller, and K. E. Crouch (GE) Mar. 1973 118 p refs
(Contract N00019-72-C-0205)
(AD-760352; U-6007) Avail: NTIS CSCL 11/4

Composite materials of boron and graphite fiber are known to be vulnerable to damage as the result of high intensity electric flow, such as induced by lightning strikes. Since these highly efficient structural materials are planned for use as primary structures of advanced aircraft, a serious question of the survivability of these structures to such electric current flow has been raised. Since very little basic information was available on the effects of high intensity electric current flow in advanced composite materials, the program was initiated to perform research into such effects and to explore possible approaches that could result in improved resistance to such damage. The approach which is being followed is to first develop a basic understanding of current degradation and flow parameters and modes, and then, using that basic information, to investigate approaches toward reducing the probability and severity of such degradation. GRA

N73-26606# Avco Corp., Lowell, Mass. Systems Div.
MICROSTRUCTURE STUDIES OF POLYCRYSTALLINE REFRACTORY OXIDES Summary Report, 29 Mar. 1972 - 28 Apr. 1973
William H. Rhodes, Philip L. Berneburg, Rowland M. Cannon, and Warren C. Steele 28 Apr. 1973 84 p refs
(Contract N00019-72-C-0298)
(AD-760353) Avail: NTIS CSCL 11/2

The program was divided into three tasks within the general topic of microstructure effects on the properties of polycrystalline oxides. The press forging process was advanced to the point where a three-inch Al2O3 hemisphere of prescribed dimensions could be forged. The product had high transmissivity and a strong crystallographic texture. Initial experiments on press forging Si3N4 are reported. Three grades of powder used in the fabrication of hot pressed 99.9% Al2O3 were found to contain particulate impurities which lead to inclusions and/or flaws in the product. Fracture origins were correlated with such flaws or other flawed features of structure in over 70% of the specimens tested. A study of gas/solid interactions in Al2O3 showed that CO was the major species evolved from material hot pressed in graphite. (Author Modified Abstract) GRA

N73-26607# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
EVALUATION OF GRP ROD AND ROPE MATERIALS AND ASSOCIATED END FITTINGS Final Report
Nixon Halsey, Richard A. Mitchell, and Leonard Mordfin Dec. 1972 89 p refs
(AD-759931; NBSIR-73-129) Avail: NTIS CSCL 11/5

An extensive and varied test program was carried out on four GRP rod and rope materials to evaluate tensile strengths, moduli of elasticity, flexibility at low temperatures, effects of stimulated Aeolian vibration, and stress-rupture properties at moderate elevated temperatures both with and without high humidity. The effects of elevated temperature on long-term storage capabilities were investigated, and diameter-temperature relationships were established for avoiding buckling due to storage in a coiled condition. The performances of five commercially available end fittings on these materials were examined in terms of the breaking loads attained in tensile tests. Using finite-element analyses, an improved end fitting was developed which is capable of approaching the true tensile strengths of two of the GRP materials. An experimental stress analysis of the improved fitting was performed. Author (GRA)

N73-26608# Stanford Research Inst., Menlo Park, Calif.
DYNAMIC FRACTURE CRITERIA FOR POLYCARBONATE AND POLYIMIDE Final Report
D. R. Curran and D. A. Shockey Mar. 1973 96 p refs
(Contract DAAD05-71-C-0180; SRI Proj. 1033)
(AD-759917; BRL-CR-91) Avail: NTIS CSCL 11/9

The report describes the results of a study of the dynamic fracture characteristics of polymers. The main objective of the study was to develop the capability to predict quantitatively the level of damage produced in polymeric materials under known dynamic loads. To accomplish this objective, disk-shaped specimens of polycarbonate, a relatively tough polymer, and polyimide, a brittle high temperature polymer, were subjected to flat-plate impact in a light gas gun under well-controlled and well-monitored conditions. For polycarbonate the stress-volume loading and unloading paths were determined under both static and dynamic conditions. Static stress-volume loading and unloading curves, an approximate constitutive relation, and the shock damage threshold stress for stress durations of about a microsecond were obtained for polyimide. A detailed study of the fracture mechanism was made for both materials. (Author Modified Abstract) GRA

N73-26609# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
A FATIGUE FAILURE CRITERION FOR FIBER REINFORCED MATERIALS
Zvi Hashin and Assa Rotem Mar. 1973 45 p refs
(Contract F44620-71-C-0100; AF Proj. 9782)
(AD-760146; MED-39; AFOSR-73-0686TR; SR-3) Avail: NTIS CSCL 11/4

A simple fatigue failure criterion for unidirectionally fiber reinforced laminae under oscillatory states of combined plane stress has been established. The criterion is expressed in terms of three S-N curves which are easily obtained from fatigue testing of off-axis unidirectional specimens under uniaxial oscillatory load. An extensive series of tests has demonstrated good agreement of the failure criterion with experimental data. Author (GRA)

N73-26610# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
FRACTURE ANALYSIS OF UNIDIRECTIONAL AND ANGLE-PLY COMPOSITES Final Report, May - Dec. 1972
G. C. Sih and E. P. Chen Jan. 1973 62 p refs
(Contract N62269-72-C-0634)
(AD-760361; IFSM-73-26; NADC-TR-73-1) Avail: NTIS CSCL 11/4

The concept of fracture mechanics is applied to analyze the brittle fracture of unidirectional and angle-ply composites. The analytical prediction based on the newly developed Sc-theory agrees well with the experimental data on Scotchply 1002 where crack propagation occurs along the fiber direction. The Sc-theory

represents a departure from the classical stress-intensity factor Kc concept in that it is designed to treat the mixed mode fracture problem while the Kc-theory is limited to Mode 1 crack extension. (Author Modified Abstract) GRA

N73-26611# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Metallurgy and Materials Science.
KINETICS OF PHASE LAYER GROWTH DURING ALUMINIDE COATING OF NICKEL
Anthony J. Hickl and Richard W. Heckel Apr. 1973 33 p refs
(Contract N00014-67-A-0314-0017; NR Proj. 031-714)
(AD-760365; TR-1) Avail: NTIS CSCL 11/3

The diffusion coating of nickel with aluminum was studied by a two-step process involving initially an influx of aluminum at the surface (aluminization) and later a partial homogenization of the aluminum-rich region under conditions of zero surface flux. The two-step process was studied in the temperature range from 870 to 1000C. The aluminization step was characterized mainly as the rapid, parabolic growth of the Ni2Al3 phase (gamma) at the surface. The homogenization step was characterized mainly as the relatively slow thickening of the NiAl phase (delta), primarily by the solution of the gamma phase. A mathematical model was developed, using numerical methods and computer techniques, which yielded growth rate predictions for the various phase layers in agreement with experimental data. The model was used to define the critical parameters controlling growth kinetics for the two-step process.
Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-26612 George Washington Univ., Washington, D.C.
SIMULTANEOUS EQUATION PRODUCTION FUNCTIONS (COBB-DOUGLAS TYPE) FOR DECISIONS PERTAINING TO SEA BASED TACTICAL AIR RESOURCES Ph.D. Thesis
Chantee Lewis 1972 220 p
Avail: Univ. Microfilms Order No. 72-33040

The need is discussed for improved analytical aids to assist management in making allocation decisions concerning the optimum allocation of military aircraft resources. C-D production functions in the area of sea-based tactical air resources. A simulaneous equation model posed. Five cases (F4J, A7E, A6, A4E, and E-2) are analyzed in depth and the model appears to fit and explain the variation in the data quite well (R squared ranges from .884 to .951). Predictions based upon the model merit serious consideration in view of the close fit and the analysis of the residuals indicating the main error is of the random covariance type. No significant bias in the data has been detected. The small covariance error appears to be due mainly to the noisy maintenance observations. Dissert. Abstr.

N73-26613 Texas Univ., Austin.
THE NUMERICAL SOLUTION OF TWO POINT BOUNDARY VALUE PROBLEMS USING THE CHEBYSHEV POLYNOMIAL SERIES Ph.D. Thesis
Terry Wayne Feagin 1972 87 p
Avail: Univ. Microfilms Order No. 73-433

The existence and uniqueness of solutions of nonlinear two point boundary value problems are discussed. The existing theory, is applied to such problems as they occur in gravitational systems, particularly with respect to the two-body problem. The Picard iteration is examined as a practical method for constructing numerical solutions of boundary value problems. The acceleration of the convergence of this method is discussed. Aitken extrapolation is applied to the Picard iteration. Newton's method is also examined as a method for constructing numerical solutions of boundary value problems. The application of the above methods when the solution is obtained as a finite Chebyshev polynomial series is discussed. A modification to Newton's method is introduced which reduces the time of computation significantly.
Dissert. Abstr.

N73-26614# Manchester Univ. (England). Inst. of Science and Technology.
IDENTIFICATION OF THE STRUCTURE OF MULTIVARIABLE STOCHASTIC SYSTEMS
M. B. Priestley, T. Subba Rao, and H. Tong Jun. 1972 25 p refs
(TR-31) Avail: NTIS HC $3.25 CSCL 12A

The problem of the identification of stochastic systems is considered in terms of constructing a model for a system with only input and output data given, and without prior information regarding physical structure. Accordingly, a discussion is made relative to the applications of principle components analysis to the problems of (a) reducing the dimension of the input variables, and (b) reducing the dimension of the output variables, using criteria which arise specifically from the control aspects of the problem. Finally, the inherent difference between the appropriate criteria for (a) and (b) is investigated and analyzed. Author

N73-26615*# Texas Technological Univ., Lubbock. Dept. of Mathematics and Statistics.
THEORY AND ANALYSIS OF STATISTICAL DISCRIMINANT TECHNIQUES AS APPLIED TO REMOTE SENSING DATA Final Technical Report, 1 Jun. 1972 - 31 May 1973
Patrick L. Odell May 1973 189 p refs
(Contract NAS9-12775)
(NASA-CR-128988) Avail: NTIS HC $11.50 CSCL 12A

Classification of remote earth resources sensing data according to normed exponential density statistics is reported. The use of density models appropriate for several physical situations provides an exact solution for the probabilities of classifications associated with the Bayes discriminant procedure even when the covariance matrices are unequal. G.G.

N73-26616# Royal Aircraft Establishment, Farnborough (England).
THE APPLICATION OF A SMOOTHING TECHNIQUE TO ANALYSE FREQUENCY RESPONSE MEASUREMENTS FOR A LINEAR SYSTEM
Rolland Dat and Jean-Louis Meurzec Feb. 1973 21 p ref Transl. into ENGLISH from Rech. Aerospatiale Chatillon-sous-Bagneux), v. 4, 1972 p 209-215
(RAE-Lib-Trans-1703; BR33566) Avail: NTIS HC $3.25

The frequency response function is represented by a rational fraction whose coefficients are calculated so as to minimize the errors between calculated and experimental values, for discrete values of frequency. The technique of calculation is described, and the method is applied to vibration test results from aircraft in flight and on the ground. The representation of the frequency response function is shown to be satisfactory over a broad frequency bandwidth. Author

N73-26617*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPARSE MATRIX METHODS BASED ON ORTHOGONALITY AND CONJUGACY
C. L. Lawson 15 Jun. 1973 66 p refs
(Contract NAS7-100)
(NASA-CR-133231; JPL-TM-33-627) Avail: NTIS HC $5.50 CSCL 12A

A matrix having a high percentage of zero elements is called spares. In the solution of systems of linear equations or linear least squares problems involving large sparse matrices, significant saving of computer cost can be achieved by taking advantage of the sparsity. The conjugate gradient algorithm and a set of related algorithms are described. Author

N73-26618*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE CORRELATION STRUCTURE OF SEVERAL POPULAR PSEUDORANDOM NUMBER GENERATORS
Frank Neuman, Robert Merrick, and Clyde F. Martin Jul. 1973 34 p refs
(NASA-TM-X-62275) Avail: NTIS HC $3.75 CSCL 12A

One of the desirable properties of a pseudorandom number generator is that the sequence of numbers it generates should have very low autocorrelation for all shifts except for zero shift and those that are multiples of its cycle length. Due to the simple methods of constructing random numbers, the ideal is

often not quite fulfilled. A simple method of examining any random generator for previously unsuspected regularities is discussed. Once they are discovered it is often easy to derive the mathematical relationships, which describe the mathematical relationships, which describe the regular behavior. As examples, it is shown that high correlation exists in mixed and multiplicative congruential random number generators and prime moduli Lehmer generators for shifts a fraction of their cycle lengths. Author

N73-26619*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONMIN: A FORTRAN PROGRAM FOR CONSTRAINED FUNCTION MINIMIZATION: USER'S MANUAL
Garret N. Vanderplaats Aug. 1973 61 p refs
(NASA-TM-X-62282) Avail: NTIS HC $5.25 CSCL 12A

CONMIN is a FORTRAN program, in subroutine form, for the solution of linear or nonlinear constrained optimization problems. The basic optimization algorithm is the Method of Feasible Directions. The user must provide a main calling program and an external routine to evaluate the objective and constraint functions and to provide gradient information. If analytic gradients of the objective or constraint functions are not available, this information is calculated by finite difference. While the program is intended primarily for efficient solution of constrained problems, unconstrained function minimization problems may also be solved, and the conjugate direction method of Fletcher and Reeves is used for this purpose. This manual describes the use of CONMIN and defines all necessary parameters. Sufficient information is provided so that the program can be used without special knowledge of optimization techniques. Sample problems are included to help the user become familiar with CONMIN and to make the program operational. Author

N73-26620*# Linguistic Systems, Inc., Cambridge, Mass.
CONCERNING THE NEGATIVE PART OF THE SPECTRUM OF ONE-DIMENSIONAL AND MULTI-DIMENSIONAL DIFFERENTIAL OPERATORS ON VECTOR-FUNCTIONS
I. M. Glazman Washington NASA Jul. 1973 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk (USSR), v. 119, Issue 3, 1958 p 421-424
(Contract NASw-2482)
(NASA-TT-F-14690) Avail: NTIS HC $3.00 CSCL 12A

Theorems are extended of previous work by I.M. Glasman concerning the spectrum of one-dimensional and multidimensional differential operators on vector functions. Given a Hilbert space of vector functions and a differential operator of specific form, it is first shown that the negative part of the spectrum of any self-adjoint expansion of an operator L is discrete and bounded below (Theorem 1). Further specification of two separate sets of conditions causes the negative part of the spectrum of operator L (1) to consist of a finite number of eigenvalues (Th. 2) and (2) to be an infinite set (Th. 3). These 3 theorems are connected with the oscillation properties of certain differential equations studied by Sternberg. Refinement of one condition of theorem 3 applied to a differential equation of second order results in the negative part of the spectrum of operator L consisting of a finite number of eigenvalues (Th. 4). Then it is proven that for specific integral types operator L with a minimum area of determination is self-adjoint and the negative part of the spectrum of operator L is discrete and semi-bounded below. Author

N73-26621*# Ohio State Univ. Research Foundation, Columbus.
COORDINATE TRANSFORMATION BY MINIMIZING CORRELATIONS BETWEEN PARAMETERS
Muneendra Kumar Jul. 1972 76 p refs
(Grant NGR-36-008-093; OSURF Proj. 2514)
(NASA-CR-132210; Rept-184) Avail: NTIS HC $6.00 CSCL 12A

This investigation was to determine the transformation parameters (three rotations, three translations and a scale factor) between two Cartesian coordinate systems from sets of coordinates given in both systems. The objective was the determination of well separated transformation parameters with reduced correlations between each other, a problem especially relevant when the sets of coordinates are not well distributed. The above objective is achieved by preliminarily determining the three rotational parameters and the scale factor from the respective direction cosines and chord distances (these being independent of the translation parameters) between the common points, and then computing all the seven parameters from a solution in which the rotations and the scale factor are entered as weighted constraints according to their variances and covariances obtained in the preliminary solutions. Numerical tests involving two geodetic reference systems were performed to evaluate the effectiveness of this approach. Author

N73-26622*# California Univ., Berkeley. Electronics Research Lab.
SOURCE ENCODING OF IMAGES FOR EFFICIENT TRANSMISSION Final Report, 18 Dec. 1972 - 17 May 1973
V. R. Algazi and D. J. Sakrison 17 May 1973 75 p refs Sponsored in part by NSF
(Grant NGR-05-003-538)
(NASA-CR-132771) Avail: NTIS HC $5.75 CSCL 12A

A set of recursive rules which generate unitary transforms with a fast algorithm are presented. For each rule, simple relations give the number of elementary operations required by the fast algorithm. The common Fourier, Walsh-Hadamard, Slant, and Haar transforms are expressed with these rules. The framework developed allows the introduction of generalized transforms which include all common transforms in a large class of identical computation transforms. A systematic and unified view is provided for unitary transforms which have appeared in the literature and for a number of new transforms of potential interest. Generalization to complex and multidimensional unitary transforms is considered. Author

N73-26623# Mitre Corp., Bedford, Mass.
THE CALCULATION OF AVAILABILITY OF SYSTEMS WITH ARBITRARY STRUCTURE AND SUCCESS CRITERIA
S. Berkovitz Mar. 1973 26 p
(Contract F19628-71-C-0002; AF Proj. 515A)
(AD-759809; MTR-2314; ESD-TR-72-160) Avail: NTIS CSCL 12/1

A recursive scheme for computing system availability from component element availabilities is developed and displayed. It requires only the knowledge of all minimal sets of components needed for successful system operation. It does not rely on any series, parallel or bridge structure but is applicable to the most general redundant systems. The scheme can be truncated at any level of recursion to yield good approximations. Included is a discussion of how the level of truncation depends on the number of system components, their availabilities and the desired accuracy. Author (GRA)

N73-26624*# Stanford Univ., Calif. Dept. of Computer Science.
NOTES ON A PROBLEM INVOLVING PERMUTATIONS AS SUBSEQUENCES
Malcom Newey Mar. 1973 25 p refs
(Contracts NSR-05-020-500; ARPA SD-183; ARPA Order 457)
(NASA-CR-133103; AD-759714; STAN-CS-73-340; AIM-190)
Avail: NTIS HC $3.25 CSCL 12/1

The problem attributed to R. M. Karp by Knuth is to describe the sequences of minimum length which contain, as subsequences, all the permutations of an alphabet of n symbols. The paper catalogs some of the easy observations on the problem and proves that the minimum lengths for $n = 5$, $n = 6$ and $n = 7$ are 19, 28 and 39 respectively. Also presented is a construction which yields (for $n > 2$) many appropriate sequences of length (n sup 2) - $2n + 4$ so giving an upper bound on length of minimum strings which matches exactly all known values. Author (GRA)

N73-26625# Air Force Academy, Colo. Frank J. Seiler Research Lab.
MEASUREMENT SUBSYSTEM PARAMETER OPTIMIZATION FOR ESTIMATION APPLICATIONS
Kenneth D. Herring Mar. 1973 96 p refs
(AF Proj. 7904)
(AD-759175; SRL-TR-73-0002) Avail: NTIS CSCL 12/1

It is well known that the type and quality of measurements play a key role in determining the quality of the results in an estimation application. It often occurs that the measurement subsystem is specified except for certain parameters. This research

presents a method whereby these parameters may be selected so as to enhance the resulting estimates. The problem is posed as the deterministic optimization of a performance index embodying the desired results with respect to the estimator error covariance and the costly measurement parameters. The error covariance differential equation of the assumed first order conditional mean estimator enters as an equality constraint on the optimization. Necessary conditions for the solution result from an application of the matrix minimum principle. Both linear and nonlinear continuous system and measurement models with additive white noise are considered. Several examples illustrate how the method is applied. Numerical results show how the optimized parameters respond to various specifications in the performance index and in the system and measurement models.
Author (GRA)

N73-26399 Grenoble Univ. (France).
SOME ASPECTS OF ANALYSIS BY CORRELATION [CERTAINS ASPECTS D'ANALYSE PAR CORRELATION]
W. Kofman *In its* Conjugate Points 5 Apr. 1973 p 28-34 refs In FRENCH (For availability see N73-26395 17-13)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-26626 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 83, NO. 3: DAILY AND MONTHLY NORTHERN HEMISPHERE 5-MILLIBAR-SYNOPTIC WEATHER MAPS OF THE YEAR 1968, APRIL - JUNE
1973 114 p
(Contract DAJA37-71-C-0993)
(QTSR-3) Avail: Issuing Activity

A series of stratospheric weather maps for the 5-mb-level are presented. Included are daily height and temperature analyses for three months for the northern hemisphere based on radiosonde and rocketsonde measurements and performed by using a hydrostatic build-up method. The corresponding monthly mean maps and their variations are included as well as the mean grid point data calculated from the daily values. The circulation pattern during the period under consideration is described with special emphasis on the processes at high latitudes. Author

N73-26627 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 133, NO. 4: THE EUROPEAN CLIMATOLOGY 1972. WEATHER SATELLITE OBSERVATIONS AT THE BERLIN APT STATION, PART 4 [METEOROLOGISCHE ABHANDLUNGEN. BAND 133, HEFT 4: DAS EUROPAEISCHE WETTERBILD 1972. WETTERSATELLITEN-DATEN AUS DEM BERLINER EMPFANGSBEREICH. TEIL IV, 4. VIERTELJAHR]
1972 220 p refs In GERMAN
(QR-4-Pt-4) Avail: Issuing Activity

The characteristics of the NOAA 2 satellite are discussed. The components of the satellite are identified as: (1) two scanning radiometers, (2) two very high resolution radiometers, (3) two vertical temperature profile radiometers, and (4) one solar proton monitor. The orbit of the satellite and the type of data obtained are described. Samples of the meteorological data are provided in the form of photographs of European weather conditions during 1972. Author

N73-26628 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 128, NO. 12: RESULTS OF THE SYNOPTIC SERVICE DURING 1972. DAILY AND MONTHLY WEATHER MAPS (GROUND, 500 mb, 850 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, DECEMBER [METEOROLOGISCHE ABHANDLUNGEN. BAND 128, HEFT 12: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1972. TAEGLICHE UND MONATLICHE WETTERKARTEN (BODEN, 500 mb, 850 mb), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, DEZEMBER]
1972 202 p In GERMAN
Avail: Issuing Activity

Daily and monthly Northern Hemisphere ground level, 500 mb and 850 mb height and temperature analyses of constant pressure levels for December are presented based on rawinsonde and atmospheric rocket sounding data. Corresponding monthly mean maps, their variations and deviations are included as well as the mean grid-point data calculated from daily values. Included scientific studies cover aspects of Berlin continuous precipitation measurements since 1851, mean and extremum values of normalized atmospheric pressure measurements for Berlin, and daily Northern Hemisphere ground weather maps for the period January 1963 through December 1972. Transl. by G.G.

N73-26629 Kansas Univ., Lawrence.
PRECIPITATION PATTERNS OF THE UNITED STATES AND SUNSPOTS Ph.D. Thesis
James Rickey Marshall 1972 133 p
Avail: Univ. Microfilms Order No. 72-32906

Analysis of the distribution of annual precipitation volume by states compared to the volume each state would have contributed to the United States volume if it had received its normal percentage of precipitation revealed systematic regional variations through time. The precipitation volumes received by the northeastern states were found to vary inversely with the volumes delivered over the high plains states. When the 5-year running departures from fair share precipitation of the northeast and the high plains were plotted against sunspot numbers it was found that deficit precipitation occurs over the high plains for a period of years on either side of every other sunspot minimum while the northeast received excess precipitation. During each interventing sunspot cycle the situation is reversed.
Dissert. Abstr.

N73-26630 Pennsylvania State Univ., University Park.
A NUMERICAL STUDY OF SHALLOW CONVECTION Ph.D. Thesis
Jiin-lang Lee 1972 104 p
Avail: Univ. Microfilms Order No. 72-33184

A numerical model of cumulus convection emphasizing the dynamic framework is developed and discussed. The model is set into an axisymmetric coordinate system and consists of equations of motion, thermodynamics and continuity. The system is treated as shallow convection thereby justifying the application of Boussinesq approximation. With functional profile assumptions in the horizontal for each variable, all equations are integrated in the radial direction and then solved numerically in the vertical direction as a function of time. The numerical experiments simulate both dry and mist convection. In the experiment with mist convection, additional equations for the continuity of water substance are included by using Kessler's microphysical parameterization. The distribution of pressure perturbation associated with the evolution of the convective cell is shown. Furthermore, the effects of the perturbed pressure on the development of a cumulus cloud are studied and discussed in detail. Dissert. Abstr.

N73-26631 Wisconsin Univ., Madison.
A CASE STUDY OF THE UNUSUAL ATMOSPHERIC CIRCULATION IN THE NORTHERN HEMISPHERE IN JANUARY 1963 Ph.D. Thesis
Theodore Latevi Lawson 1972 128 p
Avail: Univ. Microfilms Order No. 72-24890

The abnormality of the weather and circulation in January 1963 has been parameterized in terms of various indices, among them: the temperature and precipitation departures, the position and/or displacements of the centers of action, the zonal and meridional indices; the circulation pattern and the dominating wave forms and wave numbers, and what is termed the transport potential of the atmospheric flow, specifically its ability to transport heat from the lower to the higher latitudes. It was found that all these indices single out January 1963 as radically different from the 15 Januarys (1951-1965), used as the major basis for the comparison. Some comparisons based on the 1931-60 values indicate that the period may well be different within a much longer time reference. Dissert. Abstr.

N73-26632 Wisconsin Univ., Madison.
THE DYNAMICS OF THE EXTRATROPICAL CYCLONE: AN ANGULAR MOMENTUM APPROACH Ph.D. Thesis
William Keddie Downey 1972 288 p
Avail: Univ. Microfilms Order No. 72-27319

The problem of extratropical cyclone development is studied to determine the important processes for cyclogenesis. After earlier theories are reviewed a quasi-Lagrangian budget is formulated in isentropic coordinates (Johnson, 1970) to study the redistribution of mass and absolute angular momentum. Motivated by Johnson and Dutton (1969) and Johnson (1970a) the coordinate dependent viewpoints of the role of the transport and internal redistribution of absolute angular momentum are discussed. The advantages claimed for the isentropic framework are: the role of a mean mass circulation in the transport of absolute angular momentum and its relation to diabatic processes can be isolated; the mode of lateral transport is not predetermined by the quasi-geostrophic nature of large scale atmospheric motion; the pressure force is retained as a basic mechanism for internal redistribution of absolute angular momentum. Dissert. Abstr.

N73-26633 Utah Univ., Salt Lake City.
APPROXIMATION OF THE ATMOSPHERIC DENSITY AND WINDS FROM THE RADAR TRACK OF A PASSIVE INFLATABLE FALLING SPHERE Ph.D. Thesis
Ray Gary Phibbs 1972 104 p
Avail: Univ. Microfilms Order No. 72-33278

An analysis of the sphere's capability to provide density and wind information is developed and presented. This analysis is directed toward sensitivity of the sphere's position to the changes in its surrounding environment. A data reduction technique is developed (Kalman filter) which incorporates all available knowledge of the sphere-radar system to provide the best estimates of horizontal winds and the density in the higher regions of the atmosphere (50 k to 100 k). The uncertainty associated with these quantities are an integral part of the data reduction technique and are therefore automatically provided. Dissert. Abstr.

N73-26634 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 135, NO. 1: RESULTS OF THE SYNOPTIC SERVICE DURING 1973. DAILY AND MONTHLY WEATHER MAPS (GROUND, 500 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, JANUARY [METEOROLOGISCHE ABHANDLUNGEN. BAND 135, HEFT 1: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1973. TAEGLICHE UND MONATLICHE WETTERKARTEN (BODEN, 500 MB), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, JANUAR]
1973 189 p refs In GERMAN
Avail: Issuing Activity

Daily and monthly Northern Hemisphere ground level and 500 mb height and temperature analyses of constant pressure levels for January 1973 are presented. Corresponding monthly mean maps, their variations and deviations are included as well as mean gridpoint data calculated from daily values. Included scientific studies cover weather prediction for January 1973, wind gust spike measurements during 1972 median daily temperatures during 1972, and precipitation distribution from 1971 to 1972 in Berlin and vicinity. Transl. by G.G.

N73-26635 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 130, NO. 1: AEROLOGICAL DATA, BERLIN-TEMPELHOF, JANUARY 1972 [METEOROLOGISCHE ABHANDLUNGEN. BAND 130, HEFT 1: AEROLOGISCHE DATEN BERLIN-TEMPELHOF, JANUAR 1972]
1973 164 p refs In GERMAN
Avail: Issuing Activity

The detailed results of the radiosonde ascents performed by aerological stations are presented. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature and velocity of sound, were extracted for all standard pressure surfaces, several height levels, the tropopause and the freezing level. The temperature curve of the climatological mean and the data of the ozone-ascents were given in tabular and graphical form. Author

N73-26636# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
DESIGN MANUAL FOR TALL STACKS
William T. Kranz and David P. Hoult Apr. 1973 86 p refs (Pub-73-3) Avail: NTIS HC $6.50

A fluid mechanical model was developed to predict the behavior of buoyant smoke plumes. The traditional diffusion model for airborne pollutants is modified to allow for the buoyant nature of these pollutants. The results obtained agree with previous equations and observational data. It is believed that these equations are applicable in extreme situations where the previous empirical solutions fail. Author

N73-26637# Institut Royal Meteorologique de Belgique, Brussels.
SOME DATA ON THE PRESENCE OF SUBSIDENCES IN THE FREE ATMOSPHERE OVER UCCLE [ENKELE GEGEVENS OVER HET VOORKOMEN VAN SUBSIDENTIE IN DE VRIJE ATMOSFEER TE UKKEL]
A. G. Maenhout and A. VanGysegem 1973 9 p In DUTCH (Publ-Ser-B-69) Avail: NTIS HC $3.00

The results of radiosonde measurements of subsidence in the free atmosphere over the Belgian weather station, Uccle, were statistically investigated. Subsidence is a large scale descending air motion, of which the absolute velocity increases with the altitude above earth surface. In this descent, the temperature is practically dry adiabatic, as a result of which the relative humidity can obtain very small values. As the upper part of the air layer descends faster than the lower part, temperature inversions can develop. The appearance of subsidence was statistically investigated, using the results of 20 years of daily radiosonde measurements. The dewpoint depression was used as subsidence indicator. The results are as follows: under 300 mb developed subsidence does not appear, on the 600 mb level developed subsidence is most frequent, above 600 mb the frequency of developed subsidence decreases. ESRO

N73-26638# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Mar. 1973 [OBSERVATIONS CLIMATOLOGIQUES, BULLETIN MENSUEL, MARS 1973]
Mar. 1973 16 p In FRENCH and DUTCH
Avail: NTIS HC $3.00

Meteorological parameters observed at different Belgian weather stations during March 1973 are given. ESRO

N73-26639# World Meteorological Organization, Geneva (Switzerland).
[WORLD WEATHER WATCH, RESEARCH ACTIVITIES, AND TECHNICAL PROGRAMS] Annual Report, 1972
1973 66 p refs
(WMO-348) Avail: NTIS HC $5.50

Work of the WMO during 1972 in the following areas is presented: world weather watch, emphasizing the global observing system, global data processing system and global telecommunication system; the research program - GARP and development of meteorological satellites; man and his environment - discussing meteorology and food production, hydrology, aviation and oceanography; technical cooperation program; education and training; end legal and administrative business. ESRO

N73-26640# Environmental Technical Applications Center (Air Force), Washington, D.C.
WORLDWIDE AIRFIELD CLIMATIC DATA. EASTERN EUROPE, AND USSR. VOLUME 11, PART 1: CLIMATIC DATA SUMMARIZATION
Apr. 1973 192 p refs
(AD-759794) Avail: NTIS CSCL 04/2

The summarization is a part of a series of compilations which is worldwide in scope. It consists of climatological data pertaining to various weather-associated parameters for selected airfields and for the climatic areas in which they are located. The series itself, when complete, will include data for several thousand stations. This Part 1 of Volume XI contains information for stations located in Eastern Europe and the U.S.S.R. Author (GRA)

N73-26641# Environmental Technical Applications Center (Air Force), Washington, D.C.
WORLDWIDE AIRFIELD CLIMATIC DATA. EASTERN EUROPE, AND USSR, VOLUME 11, PART 2
Apr. 1973 486 p refs
(AD-759795) Avail: NTIS CSCL 04/2
For abstract, see N73-26640.

N73-26642# Texas A&M Research Foundation, College Station.
SIMULATION RESEARCH TO DEVELOP OBJECTIVE METEOROLOGICAL PREDICTION CAPABILITY, VOLUME 1 Final Report, 14 Jun. - 14 Nov. 1972
Tom E. Sanford Feb. 1973 356 p
(Contract DAAB07-68-C-0280; DA Proj. 1T0-6211-A-126)
(AD-759928; A/M-Ref-72-5A-Vol-1; ECOM-0280-F1-Vol-1; FR-9) Avail: NTIS CSCL 04/2
The study is a further evaluation of the system of equations employed currently for simulating the atmospheric friction layer. Five sets of data, each 12 hr in length, were collected in August, 1969, at Dugway Proving Ground, Utah. Preliminary solutions for these sets of data were included in Technical Reports ECOM-0280-3, dated December, 1969, and ECOM-0280-4, dated September, 1970. Subsequent to obtaining these solutions, the data were reevaluated for each of the cases. After reevaluation, solutions of the equation system for the sets of data were obtained again. The results of these solutions are included in this report, which appears in two volumes. Volume I contains solutions for five sets of data collected at Dugway. Volume II contains solutions for Cases I-A through VIII of the Dallas Tower Network Data, incorporating a modified form of the exchange coefficient derived from Deacon's wind hypothesis and miscellaneous solutions of the system of equations for a wide range of meteorological conditions. Author (GRA)

N73-26643# Texas A&M Research Foundation, College Station.
SIMULATION RESEARCH TO DEVELOP OBJECTIVE METEOROLOGICAL PREDICTION CAPABILITY, VOLUME 2 Final Report, 14 Jun. - 14 Nov. 1972
Tom E. Sanford Feb. 1973 264 p
(Contract DAAB07-68-C-0280; DA Proj. 1T0-6211-A-126)
(AD-759929; A/M-Ref-72-5A-Vol-2; ECOM-0280-F2-Vol-2; FR-9) Avail: NTIS CSCL 04/2
For abstract, see N73-26642.

N73-26644# Naval Postgraduate School, Monterey, Calif.
IMPROVING 24-HOUR CLOUD FORECASTS BY MANUALLY-MODIFIED NUMERICAL PROGNOSES BASED ON SATELLITE OBSERVATIONS M.S. Thesis
Mar. 1973 54 p refs
(AD-759986) Avail: NTIS CSCL 04/2
The results of three quasi-objective techniques for enhancing the accuracy of 24-hour cloud cover forecasts in sparse data areas, using satellite data and numerically-produced analyses and prognoses, are presented. All three of the techniques involve the modification of the analyzed 500-mb relative vorticity, as based on the satellite-observed cloud patterns and the associated changes to the prognostic fields of 500-mb relative vorticity. The study was conducted over a large area of the North Pacific Ocean for the period 9 March to 13 April 1972. (Author Modified Abstract) GRA

N73-26645# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICAL METHODS OF OBJECTIVE ANALYSIS OF METEOROLOGICAL FIELDS
N. K. Grib and I. I. Polyak 4 May 1973 17 p refs Transl. into ENGLISH from Chislennyi Prognoz Pogody i Teoriya Klimata (USSR), no. 272, 1972 p 94-101
(AD-759872; FTD-HT-23-187-73) Avail: NTIS CSCL 04/2
The method of least squares for constructing acceptable relationships is used with a large number of measurements. Within the framework of this method lies a theory of equating by elements (or equating with the use of a correlative), which makes it possible to match meteorological fields using different physical relations. Author (GRA)

N73-26646# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PERIODIC SPECTRAL SOLUTIONS OF A COMBINED SYSTEM OF EQUATIONS OF THE PLANETARY DYNAMICS OF THE ATMOSPHERE AND HYDROSPHERE
V. A. Efimov 20 Apr. 1973 33 p refs Transl. into ENGLISH from Chislennyi Prognoz Pogody i Teoriya Klimata (USSR), no. 272, 1972 p 24-43
(AD-759857; FTD-HT-23-184-73) Avail: NTIS CSCL 04/2
The article discusses a mathematical model describing the circulation of the atmosphere and the oceans. GRA

N73-26647# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. CHINESE-PHILIPPINE COASTAL MARINE AREAS. VOLUME 2: AREA 5, WENCHOW. AREA 6; TAIWAN E. AREA 7, TAIWAN W. AREA 8, SWATOW
Apr. 1973 643 p refs
(AD-760333) Avail: NTIS CSCL 04/2
The report contains data tables of marine surface observations of Chinese and Taiwan coastal areas: Wenchow, East Taiwan, West Taiwan, and Swatow. GRA

N73-26648# Air Weather Service, Scott AFB, Ill.
CATALOGUE OF LOCAL FORECAST STUDIES: INDEXES
Jan. 1973 280 p refs
(AD-760091; AWS-PAM-0-13) Avail: NTIS CSCL 04/2
Air Weather Service Pamphlet 0-13 is published to inform AWS activities of local forecast studies which are already available and where they may be obtained. It will assist AWS personnel who are planning newer studies by furnishing reference to earlier studies of similar nature and to studies from various locations having analogous problems. Such studies can be used effectively for planning approaches to the local problem and selecting the parameters to be used. With few exceptions, studies listed in this pamphlet are included in the master file of local forecasting studies maintained at USAFETAC. Author (GRA)

N73-26649# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DOPPLER RADAR INVESTIGATION OF FLOW PATTERNS WITHIN SEVERE THUNDERSTORMS Environmental Research Papers
Michael J. Kraus 8 Mar. 1973 19 p refs
(AF Proj. 6672)
(AD-760106; AFCRL-TR-73-0153; AFCRL-ERP-438) Avail: NTIS CSCL 04/2
Four severe thunderstorms were observed on a single day by the AFCRL 5.4-cm Doppler radar at Sudbury, Massachusetts. Quasihorizontal radial velocity information was used to construct maps depicting the mean within-storm flow at different elevation angles over a period of about 20 minutes. Well organized patterns in the velocity field showed either persistence or slow evolution in time throughout an appreciable range of height. The merits of this single Doppler method for the investigation of future outbreaks are discussed. Author (GRA)

N73-26650# Martin Co., Orlando, Fla. Materials Research Lab.
METHODS AND RESULTS OF REMOTE BAROMETRIC ALTIMETRY AND VIEWS ON THE ESTIMATION OF METEROLOGICAL FIELD VARIABLES
Hans Baussus VonLuetzow Apr. 1973 19 p refs
(AD-759910; ETL-RN-73-3) Avail: NTIS CSCL 08/2
The report provides a generalization of classical barometric altimetry for longer distances and explanations for some shortcomings associated with ground temperature and the weather situation. The use of weather forecasts is reviewed and error estimates under consideration of potential Army use are provided. Finally, some general views concerning the estimation of meteorological field variables are presented. Author (GRA)

N73-26651# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DETERMINATION OF AVERAGE MOTION IN PROBLEMS OF LONG TERM WEATHER FORECASTING AND THEORY OF CLIMATE

M. I. Yudin 6 Apr. 1973 21 p refs Transl. into ENGLISH from Chislennyi Prognoz Pogody i Teoriya Klimata (USSR), no. 272, 1972 p 3-14
(AD-759877; FTD-MT-24-185-73) Avail: NTIS CSCL 04/2

A model of atmospheric motion suitable for purposes of long-term weather forecasting is described. GRA

N73-26652# Army Missile Command, Redstone Arsenal, Ala.
FREQUENCIES AND DURATIONS OF SURFACE TEMPERATURES IN HOT DRY CLIMATIC CATEGORY AREAS CAT. 4, AR 70-38
Novella S. Billions Dec. 1972 44 p refs
(DA Proj. 1X2-64307-D-212)
(AD-759899; RR-72-13) Avail: NTIS CSCL 04/2

The report presents results of a study of surface temperatures and durations of extreme surface temperatures at selected stations in the hot-dry regions of the world as defined in category 4 of Army Regulation 70-38. The distribution of temperatures at and above the 5-percent probability level and their durations above 110 and 115F in the warmest months (April through October) of the year is depicted. The 110 and 115F temperature thresholds were selected for their significance to research and development of missle systems. Included in this report are levels of the temperature exceeded 1 and 5 percent of the time, distributions of the temperature at critical frequency levels, and durations of critical temperature thresholds. Author (GRA)

N73-26653# Army Electronics Command, Fort Monmouth, N.J.
ON INDIRECT PRESSURE ESTIMATION FROM MEASUREMENTS OF HEIGHT AND TEMPERATURE
Walter B. Miller Apr. 1973 34 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-759920; ECOM-5482) Avail: NTIS CSCL 04/2

The problem of estimation of atmospheric pressure at measured heights when related temperature observations are available is considered, particularly with regard to the intrinsic error properties of two commonly used forms of estimators. Results include theoretical comparisons and tables of intrinsic error values for consistent values of height and temperature variances. It is found that within the error ranges considered, the intrinsic error of pressure estimates is below those values often stated for the pressure sensor of the radiosonde package. Author (GRA)

N73-26974 National Aeronautical Establishment, Ottawa (Ontario). Unsteady Aerodynamics Lab.
THE DISPERSION OF AIRBORNE POLLUTANTS IN THE LOWER ATMOSPHERE
R. S. Crabbe *In* Natl. Res. Council of Can. Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeronaut. Est. 31 Mar. 1973 p 45-61 refs (For availability see N73-26970 17-34)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-26654 California Univ., Los Angeles.
A DEVICE FOR AUTOMATICALLY BALANCING A SPINNING SPACECRAFT Ph.D. Thesis
Jon Arthur Harrison 1972 154 p
Avail: Univ. Microfilms Order No. 72-33930

The pointing accuracy of spinning or partially spinning spacecraft is degraded by unbalance present in the rotating element. If the rotor of a dual-spin satellite is unbalanced relative to its bearing axis, this axis will perform a steady state coning motion around the system angular momentum vector. A proposal is made for installing a balancer system on the rotor to automatically and passively render the bearing axis a principal axis through the mass center of the rotor. The balancing device consists of four mass particles constrained to move in circular paths centered at the bearing axis and normal to it with two particles in each of two distinct planes. The system is capable of completely balancing the rotor about the bearing axis, i.e., rendering this axis a principal axis through the mass center of the rotor. The balancer system has a saturation level and the previous statement applies to unbalance conditions below this level. Dissert. Abstr.

N73-26655*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSITION FROM GRAVITY
R. S. Mather Jun. 1973 63 p refs Proposed for presentation at the Australian Acad. of Sci./Intern. Assoc. of Geodesy Symp. on the Earth's Gravitational Field and Secular Variations in Position, Sydney, 26-30 Nov. 1973
(NASA-TM-X-66273; X-592-73-164) Avail: NTIS HC $5.25 CSCL 17G

Procedures for obtaining position from surface gravity observations are reviewed and their relevance assessed in the context of the application of modern geodetic techniques to programs of Earth and ocean physics. Solutions based on the use of surface layer techniques, the discrete value approach, and the development from Green's theorem are stated in summary, the latter being extended to order e cubed in the height anomaly. The representation of the surface gravity field which is required in order that this accuracy may be achieved is discussed. Interim techniques which could be used in the absence of such a representation are also outlined. Author

N73-26656# Joint Publications Research Service, Arlington, Va.
NAVIGATIONAL INSTRUMENTS
12 Jun. 1973 37 p refs Transl. into ENGLISH from Izv. VUZ, Priborostr. (Leningrad), no. 3, 1973
(JPRS-59254) Avail: NTIS HC $4.00

Articles on navigation aids are summarized. Specific data cover electromagnetic forces of attraction of the rotor in electric motors, parameters for adjustable gyrocompasses, accuracy of two-channel course system with possible failure of correction channel, errors in inertial navigation systems, stabilization errors of gyrovertical with mixed gyroscope correction characteristics. For individual titles, see N73-26657 through N73-26661.

N73-26657 Joint Publications Research Service, Arlington, Va.
COMPUTATION OF UNRELIEVED ELECTROMAGNETIC FORCES OF ATTRACTION OF THE ROTOR OF AN ELECTRIC MOTOR **c09**
Ya. Ya. Berzin *In its* Navigational Instr. 12 Jun. 1973 p 1-6 ref (For availability see N73-26656 17-21)

An algorithm is presented for computing unrelieved electromagnetic forces of attraction of a rotor in small type EDG electric motors, the curve of the dependence of the unrelieved forces of attraction of the rotor on the nonuniformity of the air gap between the rotor and the stator, and recommendations for selecting the maximally allowable nonuniformity in the air gap between the rotor and the stator. Author

N73-26658 Joint Publications Research Service, Arlington, Va.
CHOICE OF SEVERAL PARAMETERS OF ADJUSTABLE GYROCOMPASSES
G. F. Bublik and V. S. Yevgenyev *In its* Navigational Instr. 10 Jun. 1973 p 7-13 refs (For availability see N73-26656 17-21)

The question of selecting basic parameters for adjustable gyrocompasses with the aid of nomograms is examined. Author

N73-26659 Joint Publications Research Service, Arlington, Va.
ACCURACY OF A TWO-CHANNEL COURSE SYSTEM WITH POSSIBLE FAILURE OF THE CORRECTION CHANNEL
A. A. Ressin *In its* Navigational Instr. 12 Jun. 1973 p 14-19 refs (For availability see N73-26656 17-21)

An analysis is given of the accuracy of a course system consisting of a gyroscopic channel and a correction channel. The precision of a system with possible failure of the corrector is analyzed. Author

N73-26660 Joint Publications Research Service, Arlington, Va.
GENERALIZED EQUATIONS OF ERRORS IN INERTIAL NAVIGATIONAL SYSTEMS
V. A. Karakashev *In its* Navigational Instr. 12 Jun. 1973 p 20-28 refs (For availability see N73-26656 17-21)

Errors in the processing of navigational information on the

movement of an object are presented as a function of errors in the analogs which model the inertial and horizon systems of coordinates. The vector differential equations are given for the errors in the modeling analogs. Author

N73-26661 Joint Publications Research Service, Arlington, Va.
NULL SHIFT IN STABILIZATION ERROR OF A GYROVERTICAL WITH MIXED GYROSCOPE CORRECTION CHARACTERISTICS
A. P. Filimonov *In its* Navigational Instr. 12 Jun. 1973 p 29-35 refs (For availability see N73-26656 17-21)

The influence of static moment and horizontal sinusoidal acceleration on the mean value of the error in stabilization of a gyrovertical with mixed gyroscope correction characteristics, is examined. Precise and approximate expressions of the error are derived. Author

N73-26662*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IN-ORBIT PERFORMANCE OF THE ITOS IMPROVED ATTITUDE CONTROL SYSTEM WITH HALL GENERATOR BRUSHLESS MOTOR AND EARTH-SPLITTING TECHNIQUE
William M. Peacock Mar. 1973 43 p refs
(Proj. ITOS)
(NASA-TM-X-66267; X-480-73-114) Avail: NTIS HC $4.25 CSCL 22B

The National Aeronautics and Space Administration (NASA), launched ITOS-D with an improved attitude control system. A Hall generator brushless dc torque motor replaced the brush dc torque motor on Tiros-M and ITOS-A. Two CO2 attitude horizon sensors and one mirror replaced the four wideband horizon sensors and two mirrors on ITOS-1 and NOAA-1. Redundant pitch-control electronic boxes containing additional electronic circuitry for earth-splitting and brushless motor electronics were used. A method of generating a spacecraft earth-facing side reference for comparison to the time occurrence of the earth-splitting pulse was used to automatically correct pitch-attitude error. A single rotating flywheel, supported by a single bearing, provided gyroscopic stability and the required momentum interchange to keep one side of the satellite facing the earth. Magnetic torquing against the earth's magnetic field eliminated the requirement for expendable propellants which would limit satellite life in orbit. Author

N73-26663# Radio Technical Commission for Aeronautics, Washington, D.C.
RECOMMENDED BASIC CHARACTERISTICS FOR AIRBORNE RADIO HOMING AND ALERTING EQUIPMENT FOR USE WITH EMERGENCY LOCATOR TRANSMITTERS (ELT)
9 Mar. 1973 18 p refs
(RTCA-SC-124; DO-154) Avail: NTIS HC $3.00

Recommended basic characteristics for airborne radio homing and alerting equipment operating on the frequencies of 121.5 and/or 243 MHz are presented. There are three categories identified by system concept. The use of these characteristics by manufacturers and users is recommended as a means of assuring that the equipment will satisfactorily perform its intended function under all conditions. In recognition of the dependent relationships of the components of the system and the undesirability of inhibiting component design, these characteristics were developed on a system basis. This does not preclude the use of a one-channel receiver operating on 121.5 or 243 MHz which incorporates homing capability. Inasmuch as measured values of radio equipment characteristics are a function of the method of measurement, suggested means of measurement are included. Author

N73-26664# Federal Aviation Administration, Washington, D.C.
APPLICATION OF AREA NAVIGATION IN THE NATIONAL AIRSPACE SYSTEM
Feb. 1973 155 p refs
Avail: NTIS HC $9.75

The proceedings of a conference to determine the potential capabilities of area navigation and how it should be implemented in the National Airspace System in an orderly manner are presented. The principal objectives of the conference were as follows: (1) to determine the advantages of radar navigation, (2) to develop a radar navigation system design concept for implementation, (3) to develop an action plan for the definition, evaluation, and implementation of a radar navigation system, (4) to define the minimum equipment operational requirements and accuracy standards for the avionics package, and (5) to specify equipment carriage requirements for operation within a radar navigation air space. Author

N73-26665# Collins Radio Co., Cedar Rapids, Iowa.
EVALUATION OF EXISTING VOR, LOCALIZER, AND GLIDESLOPE RECEIVING EQUIPMENT: IN 50-kHz/150-kHz ENVIRONMENT, INDIVIDIAL TEST RESULTS, VOLUME 1 Final Report
Wayne Ashby Jan. 1973 146 p
(Contract DOT-FA72WA-2772)
(FAA-RD-73-1-Vol-1; Rept-523-0764695-00111M) Avail: NTIS HC $9.50

Each receiver was tested under various conditions of interference in a simulated environment with an interfering adjacent channel signal (50 kHz VOR and Localizer; 150 kHz Glideslope). Some 61 types of receivers, representing all user groups, were tested to provide data on which to base geographic facility separations. Test procedure and criteria are described and the basis for the selection of the receiver types is tested. Receiver test data for various interference situations are tabulated. Author

N73-26666*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
GUIDANCE, NAVIGATION, AND CONTROL SYSTEMS PERFORMANCE ANALYSIS: APOLLO 13 MISSION REPORT
Sep. 1970 130 p refs Prepared by TRW Systems Group
(Contract NAS9-8166)
(NASA-TM-X-69528; TRW-11176-H586-R0-00-Suppl-1; MSC-02680-Suppl-1) Avail: NTIS HC $8.50 CSCL 17G

The conclusions of the analyses of the inflight performance of the Apollo 13 spacecraft guidance, navigation, and control equipment are presented. The subjects discussed are: (1) the command module systems, (2) the lunar module inertial measurement unit, (3) the lunar module digital autopilot, (4) the lunar module abort guidance system, (5) lunar module optical alignment checks, and (6) spacecraft component separation procedures. Author

N73-26667# Collins Radio Co., Cedar Rapids, Iowa.
CONTROL-DISPLAY TESTING REQUIREMENTS STUDY Final Report, 24 Jan. - 24 Jul. 1972
Kenneth E. Duning, Craig W. Hickok, Kenneth C. Emerson, and Warren F. Clement (Systems Tech., Inc.) Dec. 1972 187 p refs
(Contract F33615-72-C-1022)
(AD-759539; Rept-523-0764468-00111M; AFFDL-TR-72-122) Avail: NTIS CSCL 17/7

Control-display problems in terminal area navigation and zero visibility landing are identified along with related considerations for control laws and computations and requirements for sensors. Test and development program plans for research, development, and testing of controls and displays for full use of the capabilities of the microwave landing system are presented. Criteria and measurements for development and testing controls and displays are discussed. Procedures for evaluation of system performance, pilot performance, pilot acceptance, and safety are included. Alternative techniques for measuring pilot workload are outlined. Coordinated use of theoretical analysis, simulation, and flight test for development and testing of control-display systems is discussed. (Author Modified Abstract) GRA

N73-26668# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE AUTOMATED ASTRONOMIC POSITIONING SYSTEM Physical Sciences Research Papers
John C. Herring 16 Feb. 1973 18 p refs
(AF Proj. 4304)
(AD-760108; AFCRL-TR-73-0180; AFCRL-PSRP-543) Avail: NTIS CSCL 17/7

Astronomic positioning has been accomplished with the same

techniques and instruments for several decades. Many innovative techniques have been developed in the past to reduce instrument and observer errors. Now, however, with new technology and electronic miniaturization, the observer can be eliminated along with most of the instrument errors. A vertically oriented telescope, which has a series of slits located in the focal plane, is used to replace the observer. A microminiature fourth generation computer will control all operations and record all data observed. In addition the computer will perform an on-site computation of the astronomic position. An instrument of this type should be able to produce astronomic latitude and longitude to an accuracy of 0.3 arc sec, one sigma. Author (GRA)

N73-26669*# Naval Electronics Lab. Center, San Diego, Calif.
OMEGA VLF TIMING REVISION 1 Research and Development Report, May 1970 - Jun. 1972
E. R. Swanson and C. P. Kugel 29 Jun. 1972 190 p refs
(NASA Order S-51743-AG)
(NASA-CR-133185; AD-760311; NELC-TR-1740-Rev-1) Avail: NTIS HC $11.50 CSCL 17/G

The report specifically discusses time dissemination techniques, including epoch determination, frequency determination, and ambiguity resolution. It also discusses operational considerations including equipment, path selection, and adjustment procedure. epoch (the actual location or timing of periodic events) is shown to be both maintainable and calibratable by the techniques described to better than 3-microsecond accuracy; and frequency (the uniformity of the time scale) to about one part in 10 to the 12th power. Author (GRA)

N73-26973 National Aeronautical Establishment, Ottawa (Ontario). Flight Research Lab.
VLF NAVIGATION DEVELOPMENT AT NAE
C. D. Hardwick *In* Natl. Res. Council of Can. Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeronaut. Est. 31 Mar. 1973 p 35-43 refs (For availability see N73-26970 17-34)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-26670*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REDTOP (REACTOR DESIGN FROM THERMAL-HYDRAULIC OPERATING PARAMETERS) A FORTRAN 4 CODE FOR CALCULATING REACTOR DIMENSIONS AND MASS FROM THERMAL-HYDRAULIC CONSIDERATIONS
David L. Wilmer and Robert E. Hyland May 1973 75 p refs
(NASA-TM-X-68236; E-7467) Avail: NTIS $5.75 CSCL 18E

REDTOP, reactor design from thermal-hydraulic operating parameters is a FORTRAN 4 version 13 code that performs a single-channel, thermal-hydraulic analysis on a nuclear reactor to determine the reactor radius and mass. In addition REDTOP may be used to perform preliminary parametric analyses of proposed nuclear reactor designs. Both cermet and ceramic fuel pins in a triangular array may be analyzed. Running time is about 0.03 minute per case on an IBM 7094-7044 direct couple system. Author

N73-26671*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRELIMINARY NUCLEAR ELECTRIC PROPULSION (NEP) RELIABILITY STUDY
T. M. Hsieh, A. M. Nakashima, and J. F. Mondt 1 Jul. 1973 22 p refs
(Contract NAS7-100)
(NASA-CR-133233; JPL-TM-33-629) Avail: NTIS HC $3.25 CSCL 21C

A preliminary failure mode, failure effect, and criticality analysis of the major subsystems of nuclear electric propulsion is presented. Simplified reliability block diagrams are also given. A computer program was used to calculate the reliability of the heat rejection subsystem. Author

N73-26672*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPERIMENTAL EVALUATION OF THERMAL RATCHETING BEHAVIOR IN UO2 FUEL ELEMENTS
W. M. Phillips 1 Jul. 1973 16 p refs
(Contract NAS7-100)
(NASA-CR-133236; JPL-TM-33-622) Avail: NTIS HC $3.00 CSCL 18B

The effects of thermal cycling of UO2 at high temperatures has been experimentally evaluated to determine the rates of distortion of UO2/clad fuel elements. Two capsules were rested in the 1500 C range, one with a 50 C thermal cycle, the other with a 100 C thermal cycle. It was observed that eight hours at the lower cycle temperature produced sufficient UO2 redistribution to cause clad distortion. The amount of distortion produced by the 100 C cycle was less than double that produced by the 50 C, indicating smaller thermal cycles would result in clad distortion. An incubation period was observed to occur before the onset of distortion with cycling similar to fuel swelling observed in-pile at these temperatures. Author

N73-26673*# Versar, Inc., Springfield, Va.
INSTABILITIES IN FISSIONING PLASMAS AS APPLIED TO THE GAS-CORE NUCLEAR ROCKET-ENGINE Final Report
3 Jun. 1973 48 p refs
(Contract NASw-2378)
(NASA-CR-133235) Avail: NTIS HC $4.50 CSCL 21F

The compressional wave spectrum excited in a fissioning uranium plasma confined in a cavity such as a gas cored nuclear reactor, is studied. Computer results are presented that solve the fluid equations for this problem including the effects of spatial gradients, nonlinearities, and neutron density gradients in the reactor. Typically the asymptotic fluctuation level for the plasma pressure is of order 1 percent. Author

N73-26674# Mound Lab., Miamisburg, Ohio.
MOUND LABORATORY ISOTOPIC POWER FUELS PROGRAMS Progress Report, Jul. - Sep. 1972
30 Nov. 1972 26 p refs
(Contract AT(33-1)GEN-53)
(MLM-1983) Avail: NTIS

Research progress is reported on Pu-238 fuels for isotopic power sources including fuel preparation, fuel characterization, process studies, capsule design and testing, and creep studies and internal structure studies of refractory metals and alloys. NSA

N73-26675# Mound Lab., Miamisburg, Ohio.
MOUND LABORATORY ISOTOPIC POWER FUELS PROGRAMS: OCTOBER - DECEMBER 1972
31 Jan. 1973 23 p refs
(Contract AT(33-1)GEN-53)
(MLM-2014) Avail: NTIS

Technological achievements in the isotopic fuels program during Oct. through Dec. 1972 are reported and include: processing of sufficient fuel to fuel Pioneer capsules 18, 19, and 20 and RITE II capsules; fabrication of 6 pressed plutonium oxide (PPO) spheres for the multihundred watt program and measurement of property data for these spheres; acoustic emission testing to monitor the cracking of PPO spheres under thermal stress; studies of the effects of calcination temperatures and hydrofluoric acid concentration on the dissolution of PuO2; and development of new methods for decladding molybdenum-coated ceramic particles. Activities concerned with capsule design and testing included development of techniques for preparing iridium samples. NSA

N73-26676# Los Alamos Scientific Lab., N.Mex.
NUCLEAR SAFETY IN NUCLEAR POWER AND PROPULSION DEVICES FOR SPACE
G. A. Graves 1972 36 p refs
(LA-DC-72-1480) Avail: NTIS

The use of nuclear devices in space systems may introduce them to a wide variety of abnormal or extreme conditions in the event of system malfunctions. Undesirable circumstances

which could be encountered include explosion, fire, reentry, impact, and contact with land or water. Nuclear space systems can be studied on the ground and their nuclear safety characteristics verified or enhanced before their employment in space. Extensive research in this area has been carried on for many years in the United States and has led to the development of various means and policies through which safety is promoted or assured. These include special features in design, proscriptions on modes of operational use, and countermeasures directed at protecting against specific eventualities. Author (NSA)

N73-26677# Aerojet Nuclear Co., Idaho Falls, Idaho.
NUCLEAR TECHNOLOGY DIVISION Annual Progress Report, period ending 30 Jun. 1972
R. M. Brugger, R. L. Heath, J. F. Kunze, E. E. Burdick, and G. L. Smith Oct. 1972 502 p refs
(ANCR-1088) Avail: NTIS

The nuclear properties in a neutron interactions with nuclei were studied in fast breeder reactor. Proton reaction cross sections and beta decays for isotopes of aluminum, barium, carbon, cesium, cobalt, copper, gadolinium, gold, indium, iridium, iron, krypton, lanthanum, magnesium, neptunium, nickel, niobium, osmium, platinum, rhenium, rubidium, ruthenium, scandium, sodium, terbium, xenon, ytterbium and zirconium were observed. G.G.

N73-26678# Oak Ridge National Lab., Tenn.
NUCLEAR FUSION CHAIN REACTION APPLICATIONS IN PHYSICS AND ASTROPHYSICS
J. R. McNally, Jr. 1972 37 p refs
(SM-170/49; Conf-730302-2) Avail: NTIS

Nuclear fusion chain reactions have been proposed for supernovae and controlled fusion reactors. The concept of fusion chain reactions is traced, with emphasis on possible applications in physics and astrophysics. Reaction kinetics calculations of D. T and D. He3 fusioning plasmas reveal the presence of suprathermal particles as the end products of the reactions. These suprathermal end products can be active chain centers for the propagation of energy releasing fusion chain reactions. A Li-6D fueled fusion reactor has a calculated Lawson number lower by a factor of three compared to a pure deuterium fueled fusion reactor. Author (NSA)

N73-26679# General Electric Co., Pleasanton, Calif. Vallecitos Nuclear Center.
FISSION GAS RE-SOLUTION RATES Quarterly Report, 1 Jul. - 30 Sep. 1972
M. O. Marlowe Nov. 1972 5 p refs
(Contract AT(04-3)-189)
(GEAP-12361; QR-9) Avail: NTIS

Progress in an experimental program to determine the re-solution rates of fission gases in oxide nuclear fuels under irradiation is described. Three UO2 specimens previously irradiated and post-irradiation annealed were re-irradiated in the NTR. Microstructural characterization of archive unirradiated UO2 specimens was initiated. Author (NSA)

N73-26680# General Electric Co., Pleasanton, Calif. Vallecitos Nuclear Center.
FISSION GAS RE-SOLUTION RATES Quarterly Report, 1 Apr. - 30 Jun. 1971
M. O. Marlowe Sep. 1972 24 p refs
(Contract AT(04-3)-189)
(GEAP-12338; QR-8) Avail: NTIS

Progress in an experimental program to determine the re-solution rates of fission gases in oxide nuclear fuels under irradiation is described. The fission gas bubble size distributions obtained on the second set of irradiated UO2 specimens annealed at 1600 C for 1 hour were characterized and compared with previous results. A specimen holder for re-irradiation of previously irradiated UO2 specimens for partial re-solution of the fission gas bubbles was designed and fabrication is in progress. Author (NSA)

N73-26681# Air Force Weapons Lab., Kirtland AFB, N.Mex.
AFWL TECHNICAL OBJECTIVE NO. 4: ENGINEERING SUPPORT Technical Report, 1 Nov. 1972 - 2 Apr. 1973
William D. Collier Apr. 1973 25 p
(AD-759574; AFWL-TR-73-89) Avail: NTIS CSCL 15/6

Every U.S. Air Force aircraft and missile system with a nuclear capability must be conceived, developed, built, and operated in accordance with nuclear safety standards. The Air Force must assure itself that systems being developed with a nuclear capability have nuclear weapons that are compatible with design, safety, and operational rquirements of the Air Force. Air Force regulations and AEC/DOD agreements provide for the systematic integration of safety features into Air Force nuclear systems during all phases of development, acquisition, and operational employment. It is essential that nuclear safety technology keep well ahead of engineering development. As new systems involving radically different materials, techniques, and methods are proposed and approved, the means to evaluate them must have already been developed. (Author Modified Abstract) GRA

N73-26682# Army Foreign Science and Technology Center, Charlottesville, Va.
EXPERIMENTAL DETERMINATION OF THE WIDTH OF THE NEAR ANODE REGION IN THE KNUDSEN MODE OF A THERMIONIC CONVERTER WITH A Ba PLUS Cs
Yu. A. Dunaev and N. M. Trashbaev 15 Feb. 1973 10 p refs Transl. into ENGLISH from Gelioterkhnika (Tashkent), no. 2, 1971 p 26-32
(AD-760394; FSTC-HT-23-1277-72) Avail: NTIS CSCL 10/2

The width of the electrode potential region over the surface of the anode was measured in the presence of a transverse constant magnetic field in an overcompensated knudsen-type thermionic converter having a variable interelectrode gap filled by a Ba-Cs mixture. The pressure of the mixture did not exceed .02 torr. It is shown that increased anode voltage increases the width of the region near the anode surface, while increased current reduces the width. Experimental determination of width of the near anode region in the knudsen mode of a thermionic converter with a Ba-Cs interelectrode medium. Author (GRA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-26683 California Inst. of Tech., Pasadena.
NONLINEAR DISPERSIVE WAVES IN NONLINEAR OPTICS Ph.D. Thesis
Robert Donald Small 1973 129 p
Avail: Univ. Microfilms Order No. 73-1531

A study is made of solutions of the macroscopic Maxwell equations in nonlinear media. Both nonlinear and dispersive terms are responsible for effects that are not taken into account in the geometrical optics approximation. The nonlinear terms can, depending on the nature of the nonlinearity, cause plane waves to focus when the amplitude varies across the wavefront. The dispersive terms prevent the singularities that nonlinearity alone would produce. Solutions are found which describe periodic plane waves in fully nonlinear media. Equations describing the evolution of the amplitude, frequency and wave number are generated by means of averaged Lagrangrian techniques. The equations are solved for near linear media to produce the form of focusing waves which develop a singularity at the focal point. When higher dispersion is included nonlinear and dispersive effects can balance and amplitude profiles are found that propagate with straight rays. Dissert. Abstr.

N73-26684 Wisconsin Univ., Madison.
AUTOMATED ANALYSIS OF AEROMAGNETICS Ph.D. Thesis
Clarence Patrick Ervin 1972 253 p
Avail: Univ. Microfilms Order No. 72-24878

An iterative analysis of aeromagnetic total intensity data is developed. The gridded field is first reduced to the pole using a Fourier series approach. An algorithm is developed which substantially decreases the computation time for the reduction. Magnetic distributions are approximated by layers of poles or layers of doublets of different depths and thicknesses. The material around each grid point is assigned one of the two model types

and is treated as an independent, iterative unit with the susceptibility as the variable. The appropriate susceptibility value at each point is determined by the local fit of the calculated field to the observed field, using a weighting function derived directly from the model type assigned to the point. The overall fit for the entire array is also monitored and processing discontinued when the fit fails to improve sufficiently or specified termination criteria are met. The residual field and the geologic plausibility of the susceptibility distribution are used to manually modify the model assignments. The process is then repeated until an acceptable solution is obtained. Dissert. Abstr.

N73-26685 California Inst. of Tech., Pasadena.
ELECTROMAGNETIC WAVE PROPAGATION AND RADIATION IN A SUDDENLY CREATED PLASMA Ph.D. Thesis
Ching-Lin Jiang 1973 80 p
Avail: Univ. Microfilms Order No. 72-1530

Propagation and radiation of electromagnetic waves from oscillating sources in a suddenly created plasma are studied. Field experssions are derived through the use of Laplace transformations. The spatial distribution of sources is taken to be arbitrary but confined. Two cases are considered in detail: (1) plane wave propagation in a source-free region, and (2) electric point dipole radiation. In the case of plane wave propagation, various aspects as wave split, frequency shift, phase and group velocities, amplitude changes, power flows and energy relations are discussed. In the case of electric dipole radiation, the electromagnetic fields and instantaneous radiated power are calculated and expressed in terms of Lommel functions of two variables. Dissert. Abstr.

N73-26686# Royal Aircraft Establishment, Farnborough (England).
THEORETICAL INVESTIGATION OF THE AMPLITUDE MODULATION OF ULTRASONIC WAVES UPON PASSING THROUGH TURBULENT WATER-FLOW
G. Wittek Dec. 1972 54 p refs Transl. into ENGLISH from Mitt. Max-Planck-Inst. f. Stroemungsforschung u.d. AVA (Goettingen), no. 52, 1971
(RAE-Lib-Trans-1671; BR32908) Avail: NTIS HC $4.75

The amplitude modulation of an ultrasonic sound beam created when the sound beam impinges at right angles to a turbulent water jet flow is discussed. It is shown that amplitude modulation can give information concerning the turbulence through which the sound passes. With the help of the frequency spectrum of the amplitude modulation it is possible to recognize eddy structures in the free jet and conclusions can be drawn concerning their size and their separation from each other. Author

N73-26687# Royal Aircraft Establishment, Farnborough (England).
ON THE REDUCTION OF THE INTRINSIC NOISE AT SOUND TRANSDUCERS IN AIR FLOW (LITERATURE SURVEY)
S. Waldschutz Dec. 1972 64 p refs Transl. into ENGLISH from Deutsche Luftund Raumfahrt report DLR-Mitt-68-31
(RAE-Lib-Trans-1660; BR33084; DLR-Mitt-68-31) Avail: NTIS HC $5.25

A survey of the accessible literature dealing with the reduction of the intrinsic noise from sound transducers was made. The cited literature refers predominantly to the intrinsic noise of sound pressure transducers in air flow at flow velocities that are smaller than the velocity of sound. Author

N73-26688*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ACOUSTIC IMPEDANCE OF CURVED MULTILAYERED DUCT LINERS
William E. Zorumski Washington Jul. 1973 12 p ref
(NASA-TN-D-7277; L-8887) Avail: NTIS HC $3.00 CSCL 20A

The effect of curvature of annular duct liners on the liner acoustic impedance is examined. Exact equations are derived for the impedance of point reacting liners which are made from an arbitrary number of thin cylindrical layers of porous material separated by small radially oriented cells. Equations are given for liners with convex curvature and for liners with concave curvature. For ducts with small curvature, it is shown that these equations reduce to the equations for a flat liner. It is shown, by analytical and numerical examples, that the effect of liner curvature is significant in practical noise reduction problems. Author

N73-26689*# Scientific Translation Service, Santa Barbara, Calif.
COMPUTATION OF THE SOUND ENERGY RADIATED FROM TURBULENT FLOWS
J. C. Rotta Washington NASA Jun. 1973 26 p refs Transl. into ENGLISH of Conf. Deut. Ges. fuer Luft- und Raumfahrt, Jahrestagung, 5th, Berlin, 4-6 Oct. 1972, Paper 72-074 29 p (Contract NASw-2483)
(NASA-TT-F-14946) Avail: NTIS HC $3.50 CSCL 20A

The problem of predicting the distribution of radiated sound energy, when the distribution of mean velocity is known, is treated in two steps. First, with the use of Lighthill's equation, the energy of sound is expressed as a function of kinetic fluctuation energy and a length scale. Second, the distributions of the required field quantities are determined with the aid of the transport equation for kinetic fluctuation energy. Computed results for the axisymmetric free jet and the free mixing layer are discussed. Author

N73-26690# Institut fuer Plasmaphysik G.m.b.H., Garching (West Germany).
INVESTIGATION OF CRYOGENIC STABILITY AND RELIABILITY OF OPERATION OF Nb3Sn COILS IN HELIUM GAS ENVIRONMENT
A. P. Martinelli and S. L. Wipf Jul. 1972 11 p refs Presented at 1972 Appl. Superconductivity Conf., Annapolis, 1-3 May 1972
(IPP-4/100; Conf-720513-14) Avail: AEC Depository Libraries HC $4.00

The optimum operating temperature of coils with regard to economy of refrigeration and price of superconductor is above 4.2 K. The performance of Nb3Sn coils made of 2, 4, and 8 pancakes (ID 22 cm, OD 32 cm, tape width 0.5 cm) was tested in the 4.2 to 17 K range. The cryogenic stability limit is calculated in liquid helium to be 90 A and is measured to be 70 A in gas at 4.2 K, dropping to about 20 A when T approaches T sub c. Above these current limits, i.e., in the metastable range, the coils were tested for their response to local heating, which was applied in steady state (isothermal disturbance) or a pulse (adiabatic disturbance) of increasing power until quench occurs. compared with the experimental results. Author (NSA)

N73-26691# Addis Translations International, Woodside, Calif.
UNIFORMIZING THE DISTRIBUTION OF ILLUMINATION AT THE OUTPUT OF A HIGH POWER AMPLIFIER
A. Bettinger 3 Oct. 1972 22 p Transl. into ENGLISH from Optical-Appl. Div., Marcoussis Labs., France, report AB/jd-72.306-T Sponsored by AEC Prepared for Calif. Univ., Lawrence Livermore Lab.
(UCRL-Trans-10663; AB/jd-72.306-T) Avail: NTIS

The distribution of the population inversion over the amplifying states is discussed along with the transformation of a Gaussian distribution by an amplifier. The distribution of the gain over the amplifier stages; the distribution of the illumination at the input; the transformation and distortion of line profiles through amplification; and making the illumination uniform for the Vk 640 laser are analyzed. F.O.S.

N73-26692# EIMAC, San Carlos, Calif.
IRCM LAMP DEVELOPMENT Final Report, 1 Feb. - 31 Jul. 1972
William H. Sain and Norman C. Anderson 30 Sep. 1972 47 p
(Contract N00014-72-C-0256)
(AD-759752; EIMAC-TR-73-5) Avail: NTIS CSCL 20/6

The purpose of this program was to design, develop and fabricate two prototype CASPAR/CAIR arc lamps. The EIMAC IRCM source was patterned after the ADM-1 series E source. The lamp is of double envelope design. The inner (arc) envelope consists of a synthetic(cesium-filled) sapphire tube with refractory metal electrodes. The outer envelope, quartz/metal assembly, is evacuated to protect the inner envelope from oxidation during operation. High temperature brazing alloys for sapphire/Cb-1Zr

seals were evaluated and thermal cycling tests made on brazed seal structures. Techniques for cesium filling were investigated. Power tests were run with the sapphire inner envelope portion in a vacuum bell jar to verify the thermal design and determine basic design deficiencies. Author (GRA)

N73-26693# Naval Postgraduate School, Monterey, Calif.
THIN FILM Pb(0.9)Sn(0.1)Se PHOTOCONDUCTIVE INFRARED DETECTORS, METALLURGICAL AND ELECTRICAL MEASUREMENTS M.S. Thesis
William Godfrey McBride, Jr. Dec. 1972 89 p refs
(AD-758519) Avail: NTIS CSCL 17/5

Pb(0.9)Sn(0.1)Se thin films were deposited onto cleaved (111) CaF2 and BaF2 substrates by either an open one-boat evaporation method or a Knudson type graphite boat method. Photoconductivity was observed after isothermal annealing in Pb/Sn rich vapor to reduce their carrier concentrations to the mid-10 to the 16th power to mid-10 to the 17th power range. At 100K, 500K blackbody responsivities up to 60V/W have been developed, compared with the best blackbody responsivities around 100-125 V/W reported for commercial photo-voltaic detectors of Pb(1-x)Sn(x)Te operated at 77K. (Author Modified Abstract) GRA

N73-26694# Naval Air Development Center, Warminster, Pa. Aero-Electronic Technology Dept.
IMAGE EDGE ENHANCEMENT
Cyrus Beck 26 Apr. 1973 18 p
(AD-760320; NADC-72151-AE) Avail: NTIS CSCL 09/2

A line scan method for controlling the edge sharpness of an image is presented. The procedures consists of sensing, comparing, and suitably changing the polarity of the signals, including derivative signals, supplied to a viewing monitor. For real time application, acceptable performance depends on the speed with which the polarity of signals can be compared and changed. Author (GRA)

N73-26695# Naval Postgraduate School, Monterey, Calif.
COHERENT AND INCOHERENT COMPONENTS OF SOUND SCATTERED AT A TIME DEPENDENT ROUGH SURFACE
Clarence S. Clay (Wisconsin Univ.) 31 Dec. 1972 36 p refs
(AD-760306; NPS-61MD72121A) Avail: NTIS CSCL 20/1

Theoretical expressions are derived for the sound scattered at a time-dependent rough surface. The calculations are made for a Gaussian shaded source transducer and point receiver. The Helmholtz theorem and Fresnel approximation are used. The rough surface is assumed to be a traveling wave and to have a traveling wave packet type of correlation function. The coherent component of the signal is the product of the Fourier transformation of the surface distribution function and the smooth surface reflection signal. Comparison of theory and experiment shows the coherent component to be sensitive to the non-Gaussian character of the wind-blown water waves. The incoherent components and the temporal correlation function of the scattered sound are given. (Author Modified Abstract) GRA

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-26696 State Univ. of New York, Stony Brook.
NEUTRON SCATTERING BY ROTONS IN LIQUID HELIUM Ph.D. Thesis
Chia-Ho Huang 1972 150 p
Avail: Univ. Microfilms Order No. 73-1133

The energy momentum spectrum of the elementary excitations near the roton minimum region in superfluid helium has been measured for pressures between 1 atm and the solidification pressure and for temperatures fro 1.26 K to above the transition temperature by inelastic neutron scattering. The measurements were performed with the slow neutron chopper and time-of-flight spectrometer. By accounting for the effect of the instrumental resolution it was possible to observe a line broadening at low temperatures which sets in when the slope of the dispersion curve equals the sound velocity. There are strong indications that this is due to the roton-phonon interaction proposed by Pitaevskii. Dissert. Abstr.

N73-26697*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTRON IMPACT EXCITATION AND ASSIGNMENT OF THE LOW-LYING ELECTRONIC STATES OF CO2
Richard I. Hall and Sandor Trajmar 15 Jul. 1973 12 p refs
(Contract NAS7-100)
(NASA-CR-132202; JPL-TM-33-646) Avail: NTIS HC $3.00 CSCL 20H

Electron scattering spectra of CO2 are reported in the 7 to 10 eV energy-loss range, at energies of 0.2, 0.35, 0.6, 0.7, and 7.0 eV above threshold, and at a scattering angle of 90 deg. Several new distinct overlapping continua with weak, diffuse bands superimposed are observed to lie in this energy-loss range. The experimental spectra are discussed in the light of recent ab initio configuration-interaction calculations of the vertical transition energies of CO2. The experimental spectra are shown to be consistent with the excitation states of CO2. Author

N73-26698# Electrotechnical Lab., Tokyo (Japan).
ESTIMATION OF GENERAL ION RECOMBINATION LOSS IN HIGH INTENSITY RADIATION DOSIMETRY
Yasuyuki Moriuchi Jan. 1973 102 p refs
(Rept-736) Avail: NTIS HC $7.25

The ion recombination phenomena for accurate measurements of high intensity gas ionization in ionization chambers are considered. Ion recombination factors in poor saturation regions in which the ion collection factor is down to 0.1 or less for both cases of constant intensity and pulsed radiations are discussed on the basis of experimental results. Also described is a metrological method for precise measurements in high intensity ionization dosimetry. Author

N73-26699# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
PHASE-SPACE THEORY OF ELECTRON DETACHMENT IN SLOW ATOMIC COLLISIONS
Ven H. Shui and James C. Keck May 1973 35 p refs
(Grant NSF GP-32522X)
(Publ-73-4) Avail: NTIS HC $3.75

A classical phase-space theory for the excitation of electrons in slow atomic collisions is presented. An equation which governs the energy transfer between the electron and the heavy particles is derived for slow collisions. This equation is analogous to the first law of thermodynamics for an open system. The theory contains only one adjustable parameter and gives excellent correlation for existing experimental measurements of detachment rate coefficients of F(-) + (Ar, N2, CO) and Br(-) + Ar. Possible modifications to the present theory are summarized. The theory should be applicable to other electronic rate processes such as ionization and charge transfer. Author

N73-26700# Oak Ridge National Lab., Tenn. Health Physics Div.
[RESEARCH PROGRESS IN THEORETICAL, ATOMIC, AND MOLECULAR PHYSICS, TISSUE DAMAGE, ELECTRON AND ION COLLISIONS, AND RADIATION INTERACTION WITH SOLIDS AND LIQUIDS] Annual Progress Report, period ending 31 Jul. 1972
Sep. 1972 133 p refs
(Contract W-7405-eng-26)
(ORNL-4811) Avail: NTIS

Electron and ion collision studies cover metastable anions of CO2, ionization phenomena in several metallocenes, electron attachment to organic molecules, chemi-ionizing collisions, ion condensation reactions in benzene vapor, determination of electron affinities in collisional ionization of cesium by molecules, longitudinal electron diffusion coefficient and electron drift velocity in water vapor, thermal and near-thermal electron transport coefficients in O2, and chlorine gas evolution from irradiated rock salt. NSA

N73-26701# State Univ. of New York, Stony Brook. Dept. of Physics.
EFFECTIVE NUCLEAR MAGNETIC MOMENTS
A. Arima 1972 31 p refs
(Contract AT(11-1)-3001)
(COO-3001-32) Avail: NTIS

Two mechanisms to modify the nuclear magnetic dipole operator are discussed. They are the effects of core polarization and mesonic exchange current. The former contributes mainly to delta g sub s while the latter, to delta g. Author (NSA)

N73-26702# Rensselaer Polytechnic Inst., Troy, N.Y.
LINEAR ACCELERATOR PROJECT Annual Technical Report, 1 Oct. 1971 - 30 Sep. 1972
30 Sep. 1972 165 p refs
(Contract AT(11-1)-3058)
(COO-3058-27) Avail: NTIS

Neutron capture and total cross section studies are reported for isotopes of various reactor materials. Neutron spectra of calcium, aluminum, chromium, deuterium, gold, helium, indium, iron, lead nickel, sodium, tantalum, and uranium are considered. G.G.

N73-26703# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
TABLES OF ENERGIES OF ALPHA EMITTING NUCLIDES FOR USE IN ALPHA SPECTROMETRY
R. E. J. Porritt and J. W. Kelly Oct. 1972 53 p ref
(AAEC/TM-631) Avail: AEC Depository Libraries

Tables of the energies of alpha emitting nuclides are presented in a form suitable for the identification of the nuclides in alpha spectra. The first table lists these nuclides in increasing energy order, the second table lists them in alphabetical order of their chemical symbols, and the third table is a series of charts showing the genetic relationships in their decay schemes. Author (NSA)

N73-26704# European Atomic Energy Community, Brussels (Belgium). Bureau Eurisotop.
ACTIVATION ANALYSIS WITH GAMMA PHOTONS AND CHARGED PARTICLES FOR THE DETERMINATION OF OXYGEN IN NON-FERROUS METALS, ESPECIALLY Al, Cu, Pb AND THEIR ALLOYS, Ti, Zr, Nb, Mo, Ta, Na, Cs, Si, Ge, AND Se
Ch. Engelmann Oct. 1972 85 p refs In FRENCH
(EURISOTOP-74) Avail: AEC Depository Libraries

The principle of activation analysis using charged particles and gamma photons and the various activation processes that can be used are reviewed. The intrinsically possible sensitivities of detection for various methods are given. The interferences that can arise from other elements are examined, and it is shown how they can be eliminated completely or minimized. The principle methods of chemical separation that are used to isolate the radioisotopes for measurement in the determination of oxygen are described. The various methods applicable to the determination of oxygen in general are reviewed, and then applications particularly to nonferrous metals are given. Author (NSA)

N73-26705# Howard Univ., Washington, D.C.
RADIATION DAMAGE IN OPTICALLY TRANSPARENT MATERIALS (ZIRCON) Progress Report, 1 Feb. 1972 - 31 Jan. 1973
A. N. Thorpe, F. E. Senftle, T. Tsang, and C. Briggs 31 Jan. 1973 14 p refs
(Contract AT(40-1)-4049)
(ORO-4049-3) Avail: NTIS

Near-infrared, electron microscopic, ESR, and magnetic susceptibility measurements have been made and are reported. NSA

N73-26706# Battelle-Northwest, Richland, Wash.
SOLUBILITIES AND DIFFUSIVITIES OF HYDROGEN ISOTOPES IN NIOBIUM, NIOBIUM-ZIRCONIUM ALLOYS, AND VANADIUM AT HIGH TEMPERATURES
L. A. Charlot, A. B. Johnson, Jr., and R. E. Westerman 1972 22 p refs Presented at Intern. Meeting on the Tech. of controlled Thermonuclear Fusion Expt. and the Eng. Aspects, of Fusion Reactors, Austin, Tex., 20 Nov. 1972 Sponsored by AEC
(BNWL-SA-4473; Conf-721111-23) Avail: NTIS

Alloying elements having potentially strong interactions with hydrogen isotopes may be present in CTR first wall materials, either due to intentional alloying or because of neutron induced transmutation. The effect of zirconium (up to 20 wt percent) on the solubility and diffusivity of hydrogen and deuterium in niobium alloys was investgated at 900 C. Zirconium additions to 20 percent have little effect on hydrogen isotope diffusivity. Hydrogen-solubility data is presented for vanadium and niobium-1 zirconium alloy at temperatures of 800, 900, and 1000 C and pressures between 0.05 and 100 torr. Zirconium addition of 1 percent has negligible effect on gas solubility. A zirconium addition of 10 percent significantly increases gas solubility. Deuterium exhibits a lower solubility than hydrogen at equal pressures and temperatures for the alloys studied. Author (NSA)

N73-26707# Hanford Engineering Development Lab., Richland, Wash.
EFFECT OF PRIOR MICROSTRUCTURE ON NEUTRON DAMAGE IN STAINLESS STEEL
J. J. Laidler and B. Mastel Apr. 1972 3 p Presented at 30th Ann. Meeting and 1st Pacific Regional Conf. on the Electron Microscopy Soc. of Am., Los Angeles, Calif., 14 Aug. 1972
(Contract AT(45-1)-2170)
(HEDL-SA-407; Conf-720842-1) Avail: NTIS

Results of irradiation experiments using 316 stainless steel foils are presented. It was found that the radiation damage structure follows a trend which is closely associated with the dislocation substructure prior to irradiation. Details concerning distribution of dislocation loops, defects, and voids are included along with figures used to illustrate microstructure. NSA

N73-26708# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
ELECTROPRODUCTION EXPERIMENTS
K. Heinloth 1972 79 p refs In GERMAN Presented at Autumn Conf. on High Engergy Phys. Hamburg, 13 Sep. 1971
(Conf-710974-7) Avail: AEC Depository Libraries

An introduction to the problems of electron scattering experiments using electron accelerators is presented. Experiments, results, and experimental apparatus are reviewed. Author (NSA)

N73-26709# Aix-Marseilles Univ. (France).
STUDY OF THE IMPACT OF FINE PARTICLES ON A PIEZOELECTRIC TARGET IN VIEW OF DETERMINING THEIR MASS AND CONCENTRATION
A. Chavre 1972 204 p refs In FRENCH
(FRNC-TH-298) Avail: AEC Depository Libraries HC $12.25

A piezoelectric device was developed for measuring the size and concentration of particles produced in the cloud generated by an underground nuclear explosion with the formation of a crater. The measurement procedure can also be adapted to measure the granulometry of any type of particle in a fluid suspension. In the calibration, the diameter and velocity of the particles were varied as well as the dimensions of the piezoelectric material used. The size and concentration of particles usually encountered in radioactive clouds, particularly those associated with large quantities of fallout at places geographically remote from the explosion were studied. These principal aspects were studied: aerodynamic problems concerning the carrying away of particles, the carrying device, and the trajectory of particles near to the target; the granulometry of particles used for the calibrations and the particle distributions; the impact of particles on the piezoelectric material in relation to the target composition and measuring equipment. NSA

N73-26710# Washington Univ., Seattle. Dept. of Physics.
EFFECT OF MULTIPLE IONIZATION ON THE FLUORESCENCE YIELD OF Ne
D. Burch, W. B. Ingalls, J. S. Risley, and R. Heffner 1972 11 p refs Sponsored by AEC
(RLO-1388-189) Avail: NTIS HC $3.00

K Auger electron and K X-ray yields of Ne have been measured simultaneously in 30-MeV O-7+ collisions with Ne. Both spectra are dominated by satellite transitions. The Ne K-shell fluorescence yield is 2.4 times larger than found in identical measurements using 5-MeV incident protons. Author (NSA)

N73-26711# Atomic Energy of Canada Ltd., Chalk River (Ontario).
MATERIALS RESEARCH IN ATOMIC ENERGY OF CANADA LIMITED
1972 30 p refs
(AECL-4353) Avail: AEC Depository Libraries; Atomic Energy of Can. Ltd., Chalk River: $1.00

Research progress is described in six sections in the report. A separate abstract was prepared for each of four sections. Sections for which no abstracts were prepared are concerned with crystal defects and transport in anodic oxides. NSA

N73-26712# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
EXACT CONSIDERATION OF THE BREMSSTRAHLUNG FLUCTUATIONS IN ELECTRON TRACK PARAMETER DETERMINATION
V. I. Moroz, A. P. Stelmakh, and G. N. Tentyukova 1972 18 p refs In RUSSIAN
(JINR-P10-6868) Avail: AEC Depository Libraries

Kinematic parameters of electron tracks in propane, propane-Freon, and hydrogen-neon bubble chambers were determined from the extremum condition of the likelihood maximum function which includes the V. Geitler's distribution of radiation losses. The program is constructed realizing the algorithm of the nonlinear problem solution. Author (NSA)

N73-26713# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
DETERMINATION OF THE KINEMATIC PARAMETERS OF THE ELECTRON TRACKS USING NORMAL DISTRIBUTION WHEN TAKING INTO ACCOUNT THE FLUCTUATIONS OF RADIATION LOSSES
V. I. Moroz, A. P. Stelmakh, and G. N. Tentyukova 1973 27 p refs In RUSSIAN
(JINR-P10-6869) Avail: AEC Depository Libraries

The problem of determination of the electron track parameters in a propane bubble chamber based on the least-squares method is considered. Special attention is given to the choice of the calculation branch depending on the track length. Author (NSA)

N73-26714# Uppsala Univ. (Sweden). Inst. of Physics.
MOLECULAR ORBITALS AND LINE INTENSITIES IN ESCA SPECTRA
Ulrik Gelius Nov. 1971 41 p refs Presented at the Intern. Conf. on Electron Spectroscopy, Asilomar, Calif., 7-10 Sep. 1971 Submitted for publication Sponsored jointly by Swed. Nat. Sci. Res. Council and Knut and Alice Wallenberg Found.
(UUIP-753) Avail: NTIS HC $4.25

A model for calculating relative molecular orbital photoionization cross sections in the soft X-ray region is discussed. The model involves relative atomic subshell photoionization cross sections for the valence electrons and gross atomic charges from molecular orbital calculations. It has successfully been applied to ESCA spectra of C6H6, C4H4o, C4H4S, CF4, SF6, C3o2, and N2. Atomic subshell photoionization cross section ratios were derived for the valence electrons of C, N, O, F, and S. An alternative model involving net atomic charges and a term due to orbital hybridization is also discussed. The intensity of electron shakeup satellite lines in ESCA spectra of the core electrons is discussed in terms of the electron density at the considered core of the molecular orbital involved in the shakeup transition. Author (ESRO)

N73-26715# Uppsala Univ. (Sweden). Inst. of Physics.
ELECTRON SPECTROSCOPY FOR CHEMICAL APPLICATION
C. J. Allan and K. Siegbahn Nov. 1971 85 p refs Sponsored in part by Can. Natl. Res. Council
(UUIP-754) Avail: NTIS HC $6.25

The use of electron spectroscopy as a tool in the study of molecular structure is reviewed. The emphasis of the present report is on X-ray induced spectra. The use of X-rays to excite spectra from the valence orbital region of free molecules is discussed. The phenomenon of shake-up is considered, and the correlation of core level chemical shifts with various parameters is reviewed. The use of core level spectroscopy as a tool in chemistry is discussed. Author (ESRO)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-26716 Texas Univ., Austin.
DISPERSION OF ELECTROSTATIC ION PLASMA WAVES NEAR HARMONICS OF THE ION CYCLOTRON FREQUENCY Ph.D. Thesis
Jimmy Gary Melton 1972 124 p
Avail: Univ. Microfilms Order No. 73-485

Plasma waves which can propagate in a hot magnetized plasma near harmonic of the ion cyclotron frequency were studied numerically in the electrostatic approximation. The effects of collisionless damping processes and of finite ion Larmor radius were included. The results obtained were compared first to those obtained from common approximate equations, to determine when the approximate results are adequate to describe the waves, and then to the experimental results which were obtained at several laboratories. The numerical results show that the ion Bernstein (IB) mode, which has a resonance at each harmonic of omega sub ci, is tightly constrained to perpendicular propagation. If the IB wave deviates by as much as 1 deg from the perpendicular in hydrogen plasma, it is heavily Landau damped by electrons. Dissert. Abstr.

N73-26717 Texas Univ., Austin.
LOW FREQUENCY INSTABILITIES IN PLASMA WITH MAGNETIC SHEAR Ph.D. Thesis
Nevel Thomas Gladd 1972 99 p
Avail: Univ. Microfilms Order No. 73-440

The presence of magnetic shear in a plasma is known to have a stabilizing effect on some plasma waves. Previous studies of shear stabilization have shown that plasma models must be treated nonionically to adequately describe the effects of shear. The development of spatial eigenmode equations for collisionless drift waves and trapped particle modes is reviewed perturbation and numerical techniques to obtain their solution are applied. Stability conditions for drift wave models with electron current and temperature gradients are computed and a simple model for the electromagnetic coupling of drift waves with high frequency waves is formulated Dissert. Abstr.

N73-26718 Stanford Univ., Calif.
LAGRANGIAN DESCRIPTION OF WARM PLASMAS Ph.D. Thesis
Hongjin Kim 1972 155 p Previously copyrighted material on several pages not microfilmed at request of author. Available for consultation at Stanford University Library
Avail: Univ. Microfilms Order No. 72-30648

The averaged Lagrangian method is extended of describing small signal wave propagation and nonlinear wave interaction for cold plasmas, to the more general conditions of warm collisionless plasmas, and to demonstrate particularly the effectiveness of the method in analyzing wave-wave interactions. The theory is developed for both the microscopic description and the hydrodynamic approximation to plasma behavior. A brief discussion of specific cases of wave-wave interaction most likely to be worth subjecting to detailed numerical analysis, and some suggestions for extension of the Lagrangian method to bounded, inhomegeneous weakly turbulent plasmas of practical interest are included. Dissert. Abstr.

N73-26719 Wisconsin Univ., Madison.
THEORETICAL STUDIES OF ATOMIC AND GAS DYNAMICAL PROCESSES IN ASTROPHYSICAL PLASMAS Ph.D. Thesis
Enrique Daltabuit 1972 108 p
Avail: Univ. Microfilms Order No. 72-23308

A compilation of atomic data necessary to compute collisional ionization rates radiative recombination rates and permitted, forbidden and semiforbidden line emission rates in a gas is presented. Approximate values for the threshold energies threshold cross-sections and the energy dependence of the cross-sections for K-shell photoionization are tabulated for all ions of astrophysical interest. Results are given from a calculation of the permitted, forbidden and semiforbidden cooling coefficients for a collisionally

ionized plasma at equilibrium for temperatures from 1,000 to 100,000 K. It is shown that theory and observations of helium triplet line intensities agree within the respective uncertainties. It is proposed that the primary source of energy for quasi-stellar objects is the conversion of the kinetic energy of two colliding clouds into radiation in a pair of shock fronts at the interface. The spectrum of this energy source is computed. Dissert. Abstr.

N73-26720 University of Southern Calif., Los Angeles.
INPUT IMPEDANCE OF A SHORT, CYLINDRICAL DIPOLE ANTENNA IMMERSED IN A WARM ANISOTROPIC PLASMA - KINETIC THEORY APPROACH Ph.D. Thesis
David Takeshi Nakatani 1972 287 p
Avail: Univ. Microfilms Order No. 73-755

A theory is presented for the input impedance of a shortcylindrical dipole antenna immersed in a warm anisotropic plasma which is described by the kinetic theory (Boltzmann equation). The plasma is assumed to be homogeneous with collisions included. The input impedance is based on the induced EMF technique and a quasi-static approximation. The dipole is assumed to have a triangular current distribution along its axis. For a dipole oriented parallel to the static magnetic field, the input impedance is derived as a one-dimensional integral suitable for numerical integration. The results computed from these formulas are in good agreement with those computed from the integral formulation. Dissert. Abstr.

N73-26721*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SELF-ENERGIZED PLASMA COMPRESSOR Patent Applications
Edward L. Shriver and Eduard B. Igenbergs, inventors (to NASA) Filed 6 Jun. 1973 12 p
(NASA-Case-MFS-22145-1; US-Patent-Appl-SN-367606) Avail: NTIS HC $3.00 CSCL 20I

A self-energized plasma compressor which compresses plasma discharged from a coaxial plasma generator is described. The compressed plasma is available for use for accelerating small projectiles, such as beads of glass, to hypervelocities to simulate meteoroids. Other uses of this device may be in thermonuclear power generators for machining materials not easily machined by other methods and for any other application which may require a hot ionized high pressure gas. The novelty of the invention appears to lie in the feature of utilizing a helical shaped coil coupled to the output of the coaxial plasma generator with the coil being maintained at the same potential as the outer electrode surrounding the plasma in the coaxial generator.
NASA

N73-26722*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CATALOG OF EXPERIMENTAL PROJECTS FOR A FISSIONING PLASMA REACTOR
Chester D. Lanzo Jun. 1973 27 p refs
(NASA-TM-X-68232; E-7444) Avail: NTIS HC $3.50 CSCL 20I

Experimental and theoretical investigations were carried out to determine the feasibility of using a small scale fissioning uranium plasma as the power source in a driver reactor. The driver system is a light water cooled and moderated reactor of the MTR type. The eight experiments and proposed configurations for the reactor are outlined. E.H.W.

N73-26723# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
EQUILIBRIUM CHARACTERISTICS AND KRUSKAL-SHAFRANOV LIMIT OF A HOLLOW CYLINDRICAL PLASMA PINCH IN A TOROIDAL MAGNETIC FIELD
M. Geiger Nov. 1972 39 p refs
(LGI/R-72/9/E) Avail: AEC Depository Libraries

The radial equilibrium of a cylindrical plasma sheet of finite thickness within a concentric metallic casing is investigated under the assumptions that: (1) The magnetic confining field is a vacuum field with axial and toroidal components. (2) The plasma has a sharp boundary and carries surface currents only. (3) There is inside the plasma a trapped toroidal field. (4) The plasma pressure is constant or, in a second case, varies with the radius such that the total energy remains constant. Equilibrium characteristics are calculated for this model and plotted in equilibrium charts which indicate the displacement of the plasma as a function of its thickness (in normalized quantities). Chart parameters are the aspect ratio a and the factor k. Charts for different values of a and k illustrate the influence of the toroidicity and the relative height of the core on the equilibrium displacement. These relations are discussed in detail and show the important openings for possible confinement devices operating at higher beta and higher toroidal current. Author (NSA)

N73-26724# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ION HEATING MECHANISMS BASED ON THE ABSORPTION OF THE FAST HYDROMAGNETIC WAVE AROUND THE ION CYCLOTRON FREQUENCY
J. Adam 1972 23 p refs Presented at the Symp. on Plasma Heating and Injection, Varenna, Italy, 21 Sep. - 4 Oct. 1972 (CEA-Conf-2138; CONF-720961-7) Avail: AEC Depository Libraries

The following damping mechanisms for magneto-acoustic hydromagnetic waves are discussed: collisional damping, cyclotron damping, harmonic cyclotron damping, and amplitude of the wave. The advantages of using hydromagnetic waves for direct heating are briefly described. NSA

N73-26725# Academy of Sciences (USSR), Moscow. Fizicheskii Inst.
LASER PLASMA INJECTION INTO A STELLARATOR
E. D. Andryukhina, M. A. Bloch, G. S. Voronov, O. I. Fedyanin, Yu. V. Kholnov, and I. S. Shpigel 1972 14 p refs In ENGLISH and RUSSIAN
(NP-19656; Preprint-112) Avail: AEC Depository Libraries

The properties of a laser produced plasma trapped in the 1 = 2 TOR-1 stellarator are described. A considerable range of plasma density and ion temperature was obtained by the variation of laser energies and the confining magnetic field strength. Plasma density determination was made by a microwave interferometer; the density varies in the range of 10 to the 10th to 10 to the 12th power cm/3. NSA

N73-26726# Oak Ridge National Lab., Tenn.
POLARIZATION OF FREE-FREE BREMSSTRAHLUNG FROM MAGNETICALLY-CONFINED PLASMAS
A. C. England Feb. 1973 14 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4103) Avail: NTIS

The polarization of bremsstrahlung from electron-ion collisions is calculated for magnetically confined electrons in the Born approximation. The polarization at high temperature is found to be of opposite sign to the low temperature result and of smaller magnitude. Author (NSA)

N73-26727# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.
FUNDAMENTAL STUDIES OF TURBULENT HEATING OF A PLASMA Annual Progress Report, 1 Apr. 1972 - 31 Mar. 1973
P. Korn and C. B. Wharton 31 Mar. 1973 12 p refs
(Contract AT(11-1)-3165)
(COO-3165-3) Avail: NTIS CSCL 20I

Scaling laws and optimizing the plasma heating device are considered. Three main conclusions are described: (1) The plasma resistivity is anomalously large during turbulent heating, approaching the Buneman value normally associated with the electron 2-stream instability, yet the observed turbulent spectrum is more appropriate for ion acoustic waves; (2) the ion energy distribution is nonMaxwellian, but nearly isotropic. It has two kinds of small anisotropies, each in opposite directions. (3) The turbulent heating limits itself before the peak of the current is reached. NSA

N73-26728# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
MODEL FOR COHERENT SCATTERING OF ELECTROMAGNETIC WAVES FROM SPACIALLY BOUNDED PLASMA WAVES
O. Gehre, H. M. Mayer, and M. Tutter Jan. 1973 29 p refs In GERMAN; ENGLISH summary

(IPP-4-48) Avail: AEC Depository Libraries HC $3.50

The coherent scattering of electromagnetic waves from plasma waves which are bounded in the direction of their propagation is calculated. The waves are approximated by a moving multitude of homogeneous layers of alternating electron density. The scattering from sinusoidal density variations is obtained by means of a square-wave expansion. Author (NSA)

N73-26729# Cornell Univ., Ithaca, N.Y. Lab. of Plasma Studies.

RADIO FREQUENCY PLASMA HEATING IN THE THM-2 MIRROR MACHINE

R. W. Clark (Tex. Univ., Austin), D. G. Swanson (Tex. Univ., Austin), P. Korn, S. Robertson, and C. B. Wharton Jun. 1972 7 p refs Presented at the 1st Topical Conf. on RF Plasma Heating, Lubbock, Tex., 6-8 Jun. 1972

(Contracts AT(30-1)-3958; AT(11-1)-2194)

(LPS-95; Conf-720705-7) Avail: NTIS

Following turbulent heating in the THM-2 mirror machine, 75 kW of RF power was coupled to the hydrogen plasma through an unshielded Stix coil. The plasma density was maintained at 10 to the 12th power to 5 x 10 to the 12th power/cu cm for the 600 microsec duration of the RF pulse. Neutral energy-analyzer measurements indicate T sub i approximately 100 eV, while diamagnetic loop measurements yield 100 less than or approximately equal to T sub e + T sub i less than or approximately equal to 200 eV. Measurements also indicate that the perpendicular energy of the plasma was proportional to the net RF power input with no observable saturation. In other experiments, short bursts of RF power were applied to the plasma by means of a charged capacitor designed to ring with the antenna inductance. In these experiments, probe measurements showed discrete changes in the amplitude of the RF signals near the harmonics of the ion cyclotron frequency. Author (NSA)

N73-26730# Akademiya Nauk URSR, Kiev.

EXPLOSIVE INSTABILITIES OF WAVES IN PLASMAS WITH SPECIAL REGARD TO DISSIPATION AND PHASE EFFECTS

H. Wilhelmsson 1972 16 p refs

(ITF-72-159-E) Avail: AEC Depository Libraries

The problem of explosive instability in plasma is studied with particular emphasis on the influence of dissipation and frequency indeterminacy on the dynamic phase locking in a system of three waves. Author (NSA)

N73-26731# Institut fuer Plasmaphysik G.m.b.H., Garching (West Germany).

RESISTIVE INSTABILITIES IN PLASMAS WITH A SHEAR FLOW

I. Hofmann Aug. 1972 89 p refs In GERMAN; ENGLISH summary

(IPP-6/114) Avail: AEC Depository Libraries HC $6.50

Resistive instabilities, with particular emphasis on the tearing instability, are considered in a plane sheet pinch with shear bulk plasma flow. Analytical problems in the vicinity of singular points in the complex plane due to the small-resistivity expansion are studied in detail, and the uniform convergence of a suitably defined solution is shown. The scaling law for the growth rate is found. The region of unstable modes depends on the quotient (fluid kinetic energy/magnetic field energy); stabilization can be obtained theoretically if this quotient decreases strongly enough away from the resistive singular layer. Author (NSA)

N73-26732# California Univ., Berkeley. Lawrence Berkeley Lab.

STUDY OF A BEAM-PLASMA INSTABILITY BY SPECTROSCOPIC METHODS Ph.D. Thesis

R. A. Hess Dec. 1972 112 p refs

(Contract W-7405-eng-48)

(LBL-1531) Avail: NTIS HC $7.75

Spectroscopic methods were used to study a beam-plasma system and in particular the electric fields produced by the beam-plasma instability. A 4-keV, 40-mA electron beam of diameter 1 mm was directed into a chamber containing He at 0.3 torr. An external magnetic field of up to 7600 G was present. The electron beam can be chopped for time-resolved measurements on the initial growth of the beam-plasma instability; the rise time of the beam was to nsec and the fall time was 100 nsec. Time-resolved measurements show that the electric field of the instability grows from noise level to near saturation within a time approximately 25 nsec after the beam is turned on. The electric field is nearly entirely confined to the volume traversed by the electron beam, and has its maximum amplitude on the edge of the beam. Two different polarizations are observed for nearly the same beam and plasma parameters. These observations on the electric field are found to be generally consistent with the results of theoretical studies on the beam-plasma system. Author (NSA)

N73-26733# Columbia Univ., New York.

RESEARCH IN COMPUTATIONAL PLASMA PHYSICS Progress Report, 1 Jun. 1972 - 31 May 1973

C. K. Chu Feb. 1973 7 p refs

(Contract AT(11-1)-3086)

(COO-3086-17) Avail: NTIS

Research in computational plasma physics is proceeding well. Problems being worked on or completed during the past year include: (1) two-dimensional single-fluid code for the shock tube, (2) simulation of stuffing field, (3) further applications of the two-fluid one-dimensional code of Schneider and (4) heat transfer studies for the shock tube. Author (NSA)

N73-26734# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Technische Physik.

APPLIED MAGNETOHYDRODYNAMICS. VOLUME 10: MHD EXPERIMENTAL INSTALLATION ARGAS 2, DESCRIPTION AND OPERATING EXPERIENCE

T. Bohn, K. Grawatsch, P. Komarek, H. Lang, and G. Noack Sep. 1972 85 p refs In GERMAN

(JUL-883-TP-Vol-10) Avail: AEC Depository Libraries

The new or changed components (such as experimental zone with nozzle, channel, diffuser, seed material cycle and superconducting magnets) of the enlarged ARGAS-I facility are described. Due to the high working temperature in connection with mechanical stress some problems in the high-temperature part were found, but the electric insulation and the thermodynamic behavior of the experimental zone fits the design well. The problem of continuous injection of Cs seed was solved, polluted Cs can be shunt to a purification cycle. A few improvements were made with respect to the recording of operational data. Good results were found for the controlled resistive loads of the 98 electrodes. The construction of the superconducting magnet and the cryogenic cycle is presented in some detail. The magnetic behavior was analyzed carefully because the magnet was designed for a maximum of 4T. Author (NSA)

N73-26735# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.

REVERSE DEFLECTION AND CONTRACTION OF A PLASMA BEAM ENTERING A CURVED MAGNETIC FIELD

L. Lindberg and L. Kristoferson Dec. 1972 79 p refs Sponsored by Swed. Atomic Res. Council

(TRITA-EPP-72-32) Avail: NTIS HC $6.00

Experiments show that a beam of collisionless plasma which originally moves along a longitudinal magnetic field, when entering a region of curved magnetic field becomes deflected in the direction opposite to that in which the field is curved. It also contracts to a flat state parallel to the plane in which the magnetic field is curved. The plasma behavior is in principle understood on the basis of the gyro-center drift theory. The results of measurements and comparison with other experiments are given. ESRO

N73-26736# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.

EXPERIMENTS ON THE VELOCITY DISTRIBUTION OF A ROTATING PLASMA

J. Bergstroem and T. Hellsten 22 Dec. 1972 39 p refs Sponsored jointly by Swed. Atomic Res. Council and Bank of Swed. Tercentenary Fund

(TRITA-EPP-73-06) Avail: NTIS HC $4.00

A fully ionized rotating hydrogen plasma was generated by the crossed field technique. The velocity distribution was calculated from data obtained by means of electric potential measurements

at the end insulators of a rotating plasma device. The existence of the critical velocity phenomenon, postulated by Alfven, was confirmed and it was proved that this phenomenon was localized to the partially ionized surface layers at the end insulators. Efforts made to exceed the critical velocity were unsuccessful but they provided new information about the critical velocity mechanism. ESRO

N73-26737# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
TEMPERATURE MEASUREMENT OF AN ARGON PLASMA JET WITH A DIFFERENTIAL INTERFEROMETER [TEMPERATURMESSUNG AM ARGON-PLASMASTRAHL MITEINEM DI FERENTIALINTERFEROMETER]
H. Hailer Apr. 1971 78 p refs In GERMAN
(IPF-71-4) Avail: NTIS HC $6.00

The temperature profiles of an argon plasma were measured using differential interferometry. Temperature determination is based on the density dependence of the refractive index. The differential interferometer has the advantages of being easy to adjust, not needing high quality optical components, and being immune to mechanical displacements or damage. It is less sensitive than other interferometers, and the evaluation of an interferogram is more complicated. The plasma is produced by a plasma burner. ESRO

N73-26738# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
INTERACTION OF SHOCK WAVE PRODUCED PLASMAS WITH MAGNETIC FIELDS [ZUR WECHSELWIRKUNG STOSSWELLENERZEUGTER PLASMEN MIT STARKEN MAGNETFELDERN]
H. Schmidt Feb. 1972 219 p refs In GERMAN
(IPF-72-2) Avail: NTIS HC $13.00

The interaction of hypersonic plasma flows with magnetic fields was investigated using an experiment in which the plasma flow was produced in a gas dynamic shock tube behind a strong shock wave. In an interaction zone of 12 cm width, a quasi-stationary magnetic field, produced by a Helmholtz coil, acts transversally upon the flow. The interaction of the plasma with the field was studied using interferometric methods (Mach-Zehnder interferometer), pressure measurements (piezoelectric pressure gages), and light emission measurements. The following phenomena were observed: the plasma flow is slowed down from supersonic to subsonic; pressure increases in interaction zone; plasma heating increases electron density; ionization limits temperature increase; primary shock wave velocity decreases to 15%; compression waves, originating in interaction zone go to contact front and further in driver gas; and these waves are partly reflected on contact front. ESRO

N73-26739# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
ION DIFFUSION IN THE ELECTRODE BOUNDARY LAYERS OF A CATHODE SPOTLESS DISCHARGE LATERAL TO A PLASMA FLOW [IONENDIFFUSION IN DEN ELEKTRODENGRENZSCHICHTEN EINER BRENNFLECKLOSEN ENTLADUNG QUER ZU EINER PLASMASTROEMUNG]
B. F. Forster Mar. 1972 105 p refs In GERMAN
(IPF-72-3) Avail: NTIS HC $7.25

An electric discharge between flat electrodes parallel to a laminar nitrogen plasma flow, at a gas temperature of about 6000 K and a pressure of 1 atm was investigated. A potential sonde was used to measure the voltage drop in the cathode boundary layer of the discharge. The discharge is manifested in various forms: a low current discharge with saturation character in the discharge current, and a high current discharge. It is known from sonde theory that for a sonde negative to plasma potential, and without thermal emission, the sonde current is carried by ions in the plasma/sonde boundary layer. Based on this concept, the characteristics of the low current discharge was calculated. Theoretical characteristics were compared with experimental results. For pure tungsten and thoriated electrodes, a good agreement was obtained. ESRO

N73-26740# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
SNOWPLOW CALCULATIONS FOR COAXIAL ACCELERATORS AND FOCUSING DEVICES [SCHNEEPFLUGRECHNUNGEN FUER KOAXIALE BESCHLEUNIGER UND FOKUSAPPARATUREN]
U. Erz Apr. 1972 130 p refs In GERMAN
(IFP-72-4) Avail: NTIS HC $8.50

The plasma acceleration and compression in a coaxial plasma accelerator with focussing equipment was investigated, with special attention paid to the energy of the focus plasma at the end of the compression phase. Calculations are based on two neutron models: moving-boiler and beau-target model. Five criteria are elaborated on which are responsible for the focus plasma energy. Equations of motion, voltage, and power are developed and numerically integrated. The equations of motion are based on the snowplow model. The electrical and mechanical parameters are varied to investigate the effects on the five criteria. The magnitude of the external inductivity is shown to be of major influence. A comparison is made of the snowplow results and experimental data. ESRO

N73-26741# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
DEVELOPMENT AND STUDY OF A CAPACITOR FED MAGNETIC COIL FOR GENERATION OF HOMOGENEOUS MAGNETIC FIELDS IN THE REGION OF APPROXIMATELY 60 kG [ENTWICKLUNG UND UNTERSUCHUNG EINER KONDENSATOR-GESPEISTEN MAGNETFELDSPULE ZUR ERZEUGUNG HOMOGENER MAGNETFELDER IM BEREICHUM 60 KG]
K. Hirsch Jul. 1972 50 p refs In GERMAN
(IPF-72-7) Avail: NTIS HC $4.50

A modified helical wound coil was used for the production of a high, homogeneous, quasi-stationary magnetic field (B larger than or equal to 60 kG). The interference produced by the middle part (a winding with high pitch), with a diagnostics opening, was cancelled by two symmetric, segmented coil parts of varying current density distribution. At the same time a large range homogeneous field distribution in axial direction was obtained. 30 capacitors of 7.7 micro F and 18 kv were used as energy storage mediums. ESRO

N73-26742# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
CHARACTERISTIC EXAMPLES OF WAVE PROPAGATION IN INHOMOGENEOUS PLASMAS [CHARAKTERISTISCHE BEISPIELE DER WELLENAUSBREITUNG IN INHOMOGENEN PLASMEN]
E. Raeuchle Aug. 1972 112 p refs In GERMAN
(IPF-72-8) Avail: NTIS HC $7.75

The propagation of electromagnetic waves in a restricted inhomogeneous plasma was investigated using two examples: partly plasma-filled cylindrical cavity resonators, and a positive column in an external magnetic field. For solution of the coupled linear, homogeneous differential equations systems, a method was developed, allowing the calculation of eigenvalues and eigensolutions. These may be complex, as is often the case in plasma wave propagation. The residue calculation to obtain the eigenvalues has been adapted to the physical problems. ESRO

N73-26743# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
HOLOGRAPHIC INTERFEROMETRY IN A VIBRATING ENVIRONMENT
F. P. Kuepper and W. J. Mastop Jun. 1972 20 p refs Sponsored jointly by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-72-70) Avail: NTIS HC $3.00

The interferometric measurement of the index of refraction of a transparent phase object with conventional interferometers is impossible if the optical paths are disturbed by vibrations of the components before or during the measurement. In the case of transient phase objects, this problem can be solved by the application of holographic interferometry using a giant pulse ruby laser. That laser emits two light pulses, one before and one during the appearance of the phase object. The method is employed to detect the integral of the electron density of a plasma in a toroidal arc experiment. Author (ESRO)

N73-26744# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).

EQUILIBRIUM OF A WEAKLY TOROIDAL PLASMA COLUMN SURROUNDED BY A TRKAL-FIELD
W. Schuurman Dec. 1972 10 p refs Sponsored jointly by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-72-71) Avail: NTIS HC $3.00

The toroidal shift of a weakly toroidal plasma column surrounded by a tenuous plasma in a Trkal-field and by a metal wall is calculated. Comparison is made with similar calculations for a plasma column surrounded by either a vacuum or a tenuous plasma in a magnetic field with constant pitch. Author (ESRO)

N73-26745# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
COMPARISON OF TOROIDAL SCREW PINCH EXPERIMENTS WITH ONE-DIMENSIONAL MHD COMPUTER CALCULATIONS
P. C. T. VanderLaan, Adri Nijsen-Vis, and W. Kooyman Dec. 1972 20 p refs Sponsored jointly by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-72-72) Avail: NTIS HC $3.00

The field and pitch distributions measured in a toroidal screw pinch device are compared to the field and pitch distributions calculated by means of the Culham one-dimensional MHD code. This comparison, which is made for five different programmings of the applied fields, shows a fair agreement in the outside region. To derive the pitch from the measured field components, it is necessary to find the location of the displaced toroidal magnetic surfaces. The origin of the low-density plasma is discussed, as well as the possible role of anomalous resistivity.
Author (ESRO)

N73-26746# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
LINEAR AND NONLINEAR TONKS-DATTNER RESONANCES IN LABORATORY AFTERGLOW PLASMAS Physical Sciences Research Paper.
K. V. N. Rao 7 Feb. 1973 40 p refs
(AF Proj. 4642)
(AD-759789; AFCRL-PSRP-533; AFCRL-TR-73-0094) Avail: NTIS CSCL 20/9

The electroacoustic resonances commonly known as Tonks-Dattner resonances were excited in neon, argon, xenon and mercury afterglow plasmas using microwaves in the frequency range 2 to 4 GHz. The afterglow plasmas were produced by high voltage dc pulses across electrodes in cylindrical discharge tubes located in S-band waveguides. Peak electron densities are measured utilizing the electroacoustic resonances. These are compared with those measured simultaneously using the microwave cavity perturbation technique. The nonlinear interaction of the transverse electromagnetic waves with the inhomogeneous plasma is probed as the excitation signal strength is increased from microwatts to hundreds of milliwatts. The second harmonic amplitude of the signal emitted from the plasma column when excited at plasma resonance is probed as a function of the excitation field strength and also as the gas pressure is varied. (Author Modified Abstract) GRA

N73-26747# Naval Research Lab., Washington, D.C. Plasma Physics Div.
DEPARTURE FROM LOCAL THERMODYNAMIC EQUILIBRIUM (LTE) IN AN OXYGEN PLASMA. 1: RADIATIVE CASCADE LIMIT Interim Report
E. S. Oran, J. Davis, and P. S. Julienne (NBS) Mar. 1973 26 p refs
(AD-759010; NRL-MR-2577) Avail: NTIS CSCL 07/4

A radiative cascade model of the excited state population densities in a recombining oxygen plasma is described. The departure from local thermodynamic equilibrium (LTE) coefficients calculated using all atomic energy levels up to principal quantum number 20 are obtained for all angular momentum states. The emitted infrared radiation is also discussed. Author (GRA)

N73-26748# Westinghouse Research Labs., Pittsburgh, Pa.
ABSORPTION AND EMISSION COEFFICIENTS FOR ARGON PLASMAS Final Report
R. W. Liebermann and J. J. Lowke Apr. 1973 30 p refs
(Contract F33615-72-C-1405; AF Proj. 7063)
(AD-759571; ARL-73-0053) Avail: NTIS CSCL 20/9

In order to calculate spectral absorptivities of argon as a function of temperature, calculations have been made of the composition of argon plasmas for pressures of up to 1000 atmospheres and temperatures of up to 25,000 K. Account is taken of deviations from that of an ideal gas by use of the second virial coefficient and it is found that the maximum deviation of behavior from that of a perfect gas is 12%. Calculations indicate that equilibrium mole fractions of the molecular ion A2(-) are generally less than 0.001. Computer programs have been developed to calculate continuum radiation using the calculated equilibrium composition. Radiation from the continuum produced by electrons combining with doubly ionized atoms is calculated using the quantum defect method. (Author Modified Abstract)
GRA

N73-26749# Naval Postgraduate School, Monterey, Calif.
ELECTROHYDRODYNAMICS (EHD) RESEARCH Final Report, 1971-1972
Oscar Biblarz 12 Feb. 1973 100 p refs
(AD-759971; NPS-57ZI73021A) Avail: NTIS CSCL 20/9

The report contains further considerations of the slip parameter for unsteady flow. Several important gas/particle combinations are represented and conclusions regarding electrical efficiency are given. Also, a computer study which solves the combines Laplace/Poisson equations for geometries representing the EHD channel is included. This program is used to predict the effect of voltage scheduling electrodes, and the predictions are checked out experimentally. Author (GRA)

N73-26750# KMS Technology Center, Irvine, Calif.
THEORETICAL INVESTIGATION OF THE EFFECT OF PARTICLE CONTAMINANTS ON LASER-INDUCED AIR BREAKDOWN Technical Report, 22 Jun. 1971 - 30 Aug. 1972
Frank D. Feiock and Lester K. Goodwin Apr. 1973 197 p refs
(Contract F29601-71-C-0118; ARPA Order 1256; AF Proj. 1256)
(AD-760175; AFWL-TR-72-172) Avail: NTIS CSCL 20/9

The effect of atmospheric contaminants on the laser-induced breakdown of air is investigated. Calculations were performed using a one-dimensional, Lagrangian, hydrodynamic code developed for the study. The results of this study indicate that the interaction of a laser beam with atmospheric contaminants such as SiO2 and Al2O3 can supply a primary electron density that will lead to a significant decrease in the laser-induced breakdown threshold for air. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-26751* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MONITORING DEPOSITION OF FILMS Patent
James L. Zurasky, inventor (to NASA) Issued 5 Jun. 1973 5 p Filed 18 Nov. 1971 Supersedes N72-20736 (10 - 11, p 1515)
(NASA-Case-MFS-20675; US-Patent-3,737,237; US-Patent-Appl-SN-200085; US-Patent-Class-356-161; US-Patent-Class-356-108; US-Patent-Class-356-202; US-Patent-Class-250-219TH) Avail: US Patent Office CSCL 20L

A system using dual wavelength characteristics of light passing through a film being deposited was described to generate an output signal that changes rapidly at the point when the deposition process should stop or change. Photodetectors are used to sense the light intensity changes at the two wavelengths, and the monitored signal represents the ratio of their sums and difference signal strengths.
Official Gazette of the U.S. Patent Office

N73-26752* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TWISTED MULTIFILAMENT SUPERCONDUCTOR Patent
Willard D. Coles, inventor (to NASA) Issued 5 Jun. 1973 6 p Filed 17 Aug. 1972 Supersedes N72-31740 (10 - 22, p 3002)
(NASA-Case-LEW-11726-1; US-Patent-3,737,824; US-Patent-Appl-SN-280031; US-Patent-Class-336-200; US-Patent-Class-29-599; US-Patent-Class-156-18; US-Patent-Class-174-DIG.6; US-Patent-Class-336-DIG.1) Avail: US Patent Office CSCL 20L

Masking selected portions of a ribbon and forming an intermetallic compound on the unmasked portions by a controlled diffusion reaction produces a twisted filamentary structure. The masking material prohibits the formation of superconductive material on predetermined areas of the substrate.
Official Gazette of the U.S. Patent Office

N73-26753 Pennsylvania State Univ., University Park.
POLARONS IN A UNIFORM MAGNETIC FIELD Ph.D. Thesis
Richard Michael Parker 1972 170 p
Avail: Univ. Microfilms Order No. 72-33196

To study the polaron in a uniform magnetic field, an understanding of the free electron problem is needed. Choosing the symmetric gauge, the problem is solved using an algebraic technique, similar to that used on the harmonic oscillator problem. The creation and annihilation operators obtained are also useful in the polaron problem. The infinite degeneracy of the free electron and polaron eigenstates is shown using these operators. A discussion of other general properties of the polaron is given. The dynamic and adiabatic approximations can be applied to the polaron in a uniform magnetic field. However, the situation where the dynamic approximation is used parallel to the magnetic field and the adiabatic approximation perpendicular to the magnetic field is also physically reasonable. This approach is called the mixed coupling theory. In addition to perturbative theories, variational theories are used representing all three points of view to study the polaron energy corresponding to the lowest free electron Landau level. This energy is obtained as a function of the polaron z-momentum. Dissert. Abstr.

N73-26754 Pennsylvania State Univ., University Park.
PIEZO- AND THERMO-OPTICAL PROPERTIES OF BISMUTH GERMANIUM OXIDE Ph.D. Thesis
Peter Hennessey 1972 140 p
Avail: Univ. Microfilms Order No. 72-33172

The pressure and temperature dependence of the optical constants (refractive index, absorption coefficient, optical rotatory power, and ellipticity) of Bi12GeO20 (BGO) single crystals was determined, as a function of wavelength between 0.36 and 0.64 microns, pressures up to 14 kbars, and temperatures up to 320 C. The value of the thermal expansion coefficient is also reported. The optical analog of the photoconductivity peaks (reported in the literature) was found in the form of a luminescent emission for incident wavelengths less than 0.4 + or - 0.01 microns and whose wavelength is 0.54 + or - 0.01 microns. The polarimetric measurements suggest that the luminescence, at the moment it is emitted, has the same state of polarization as that of the incident light. Dissert. Abstr.

N73-26755 Kansas State Univ., Manhattan.
OPTICAL AND ELECTRICAL CONDUCTIVITY STUDIES OF ION IMPLANTED INSULATORS Ph.D. Thesis
James Robert Crawford 1972 149 p
Avail: Univ. Microfilms Order No. 73-1160

A study of ion implantation in insulators, both implanted impurities and lattice damage, were considered. Optical studies were carried out in connection with certain implanted impurities and optically active lattice defects. Electrical conductivity studies were employed to study defects which act as traps and affect the conduction processes. Almost all of the optical studies were done with MgO, while Al2O3 was used in the conductivity studies. The conductivity studies were carried out on the surface of Al2O3 disks. The intrinsic surface conduction was found to be ohmic at lower bias and space charge limited at higher bias. The sample then was implanted with Cr but not annealed. The Cr interstitials and implant damage resulted in a noticeable increase in the number of traps which take part in the conduction process and yield an initial hysteresis. Dissert. Abstr.

N73-26756 California Univ., Los Angeles.
ELECTRON PARAMAGNETIC RESONANCE OF DILUTE MAGNETIC ALLOYS: Mg:Gd AND NOBLE-METAL:RARE-EARTH Ph.D. Thesis
Lung-Jo Tao 1972 122 p
Avail: Univ. Microfilms Order No. 72-33993

Using electron paramagnetic resonance technique, the crystal field effect and the conduction electron-local moment exchange interaction were studied of dilute magnetic alloys of Mg:Gd, Au:Gd, Au:Er, Au:Dy, Au:Yb, Ag:Gd, Ag:Dy, and Cu:Er. In Mg:Gd, an unresolved, exchange narrowed fine structure was observed. It was analyzed using the full coupled localized conduction electron transverse susceptibility expression derived by Barnes. An exchange coupling constant J = 0.4 eV and a fine structure parameter D = 140 G are extracted from a fit to the theory. Anisotropic Gamma sub 8 (quartet) resonance was observed in Au:Dy. The field for resonance determined the ratio and the sign of the crystal field parameters, B4/B6 = 1310 + or - 30, to be compared with that found for Ag:Dy alloys with Gamma sub 7 doublet as ground state, equal to or less than 319. Multilevel relaxation was discussed. The linewidth yielded an exchange-coupling constant J = 0.14 + or - 0.05 eV. Dissert. Abstr.

N73-26757 Pennsylvania State Univ., University Park.
OPTICAL SPECTRA AND CRYSTAL FIELD PARAMETERS OF NEODYMIUM IN LANTHANUM ALUMINATE Ph.D. Thesis
Pillalamarri Sitaramanjaneyulu 1972 120 p
Avail: Univ. Microfilms Order No. 72-33203

The spectrum of Nd(3+) was obtained in a 12-coordinated host, LaAlO3, from which a complete set of crystal field parameters, Racah parameters, and the spin-orbit coupling constant were derived. Polarized absorption spectra at liquid nitrogen and liquid helium temperatures and polarized fluorescence spectra at liquid nitrogen temperature were measured from oriented single crystals of La(0.95)Nd(.05)AlO3 and La(0.99) Nd(0. 01)AlO3. Some spectral broadening and frequency shifts with temperature were observed. Some satellite structure was observed, even at liquid helium temperature. The spectral terms and the individual energy levels were identified and labeled. Selection rules for electric and magnetic dipole and electric quadrupole interactions were derived for both polarization directions. On the basis of the ionic-point-charge model the crystal field potential was constructed and the interaction matrices were derived utilizing Racah's tensor operator techniques in conjunction with the Wigner-Eckart theorem. Dissert. Abstr.

N73-26758 Brown Univ., Providence, R.I.
NONLINEAR OPTICAL SUSCEPTIBILITIES OF SEMICONDUCTORS Ph.D. Thesis
Michael Isaiah Bell 1972 244 p
Avail: Univ. Microfilms Order No. 73-2231

The nonlinear susceptibility tensor which couples electromagnetic waves of frequencies omega 1 and omega 2 to produce polarizations at frequencies omega 1 + or - omega 2, has been calculated for zinc-type semiconductors. At frequencies well above the transverse optical phonon frequency, it is sufficient to consider only purely electronic processes, and these are calculated using a simplified model of the band structure. Good agreement with experiment is obtained for the case of second-harmonic generation (omega = omega 1 = omega 2), both in the low-frequency limit and for the dispersion produced by interband transitions. Other situations of experimental interest, optical rectification (omega 1 = -omega 2) and the electro-optic effect (omega = 0), involve frequencies below the TO-phonon frequency, so that the contribution of the lattice to chi sq must be included. This lattice contribution, which is directly related to the Raman scattering cross-section, is also calculated from the band-structure model and found to be substantial. Dissert. Abstr.

N73-26759 Delaware Univ., Newark.
LUMINESCENCE IN HEAVILY DOPED ZnS:Cu, In PHOSPHORS Ph.D. Thesis
Martin Leonard Lonky 1972 110 p
Avail: Univ. Microfilms Order No. 72-32004

The optical and strcutural properties of heavily doped ZnS-Cu, In were measured on crystals grown from the vapor. The results of photoluminescence, thermoluminescence, photoconductivity

and electrical conductivity were compared to similar systems with lower dopant concentrations. The ability of these crystals to store electronic energy at low temperatures has been related to the laminar morphology disclosed under a scanning electron microscope. The model advanced explains all the physical data shown, and accounts for the broad, structureless thermoluminescence observed in these phosphors. The storage of electronic energy is attributed to the separation of electrons at opposite surfaces of the laminae. Additional structural defects which from part of the composite system are noted, and their direct relationship to the physical data is discussed. Dissert. Abstr.

N73-26760 Yale Univ., New Haven, Conn.
ELECTRON EMISSION FROM AMORPHOUS AND CRYSTALLINE SILICON Ph.D. Thesis
Mehmet Erbudak 1972 101 p
Avail: Univ. Microfilms Order No. 72-29731

Annealing properties of vacuum cleaved silicon (111) crystals are compared with those of amorphous silicon prepared by vapor quenching in ultrahigh vacuum. Electronic properties of surfaces, such as work function, ionization energy, electron affinity, position of the Fermi level in the band gap, spectrum of surface states, and density of states in the valence band with emphasis on the tail of localized states reaching the Fermi level, are determined for each stage of anneal for both cleaved and amorphous silicon. Photoelectric emission and secondary electron spectroscopy are used to establish the relationship between the atomic and electronic structures of silicon surfaces. Low energy electron diffraction is used to determine the atomic structure of the silicon surfaces. It was found that amorphous silicon films crystallize around 800 K, however, the surfaces show three different structures when annealed at increasing temperatures.
Dissert. Abstr.

N73-26761 Wisconsin Univ., Madison.
NIOBIUM THIN FILM SUPERCONDUCTIVE TUNNEL JUNCTIONS USING A SEMICONDUCTOR BARRIER Ph.D. Thesis
William Henry Keller 1972 147 p
Avail: Univ. Microfilms Order No. 72-27333

Superconducting tunnel junctions were fabricated using RF sputtered niobium, RF sputtered semiconductor (germanium and indium antimonide) barrier and evaporated lead thin films. A photo resist process using RF sputter etching to define the niobium patterns was perfect. The current-voltage characteristics of the tunnel junctions were investigated and from these characteristics an effective rectangular barrier height for each junction was calculated. A barrier model was proposed which incorporates a barrier height that decreases as barrier thickness increases. The barrier model for the germanium and indium antimonide barriers consists of a potential at the surface of the semiconductor, decreasing towards the center of the barrier region to a limiting potential value determined by the bulk characteristics of the semiconductor. The deposited semiconductor films produced tunnel junctions with characteristics which were reasonably reproducible and which changed only mildly and uniformly with age. Dissert. Abstr.

N73-26762# Joint Publications Research Service, Arlington, Va.
THIRD SYMPOSIUM ON THE GROWTH AND SYNTHESIS OF SEMICONDUCTOR CRYSTALS AND FILMS
L. N. Aleksandrov et al 6 Jun. 1973 249 p refs Transl. into ENGLISH of the publ. "3 Simpozium po Protsessam Rosta i Sinteza Poluprovodnikovykh Kristallov i Plenok" Novosibirsk, 1972 245 p Conf. held at Novosibirsk, USSR, 12-17 June 1972
(JPRS-59208) Avail: NTIS HC $14.50

Summaries of reports are presented which were given at the third symposium on the growth and synthesis of semiconductor crystals and films. The symposium was held at Novosibirsk on 12-17 June 1972. Author

N73-26763# Royal Aircraft Establishment, Farnborough (England).
PRODUCTION OF SCREEN-PRINTED INDUCTIVE COMPONENTS USING FERRITE PASTES
A. F. Bogenschutz, P. H. Krahl, and H. Plumpe Jan. 1973 16 p refs Transl. into ENGLISH from Ber. Deut. Keram. Ges. (West Germany), v. 49, no. 4, 1972 p 114-118
(RAE-Lib-Trans-1690; BR33402) Avail: NTIS HC $3.00

The miniaturization of screen-printed inductances with sufficiently good properties was investigated. By sandwiching noble-metal coils between layers of ferrite it was possible to increase inductance values 20 to 30 times (depending on the layer thickness). The inductance values without ferrite were 0.14 or 0.11 micron H. The ferrite layers were produced by printing and firing ferrite pastes. Best results were obtained by repeated printing, in which a layer of coarse-grained ferrite is applied to be followed by a fine-grained layer: then the metal coils are deposited which in turn are covered by more successive layers as described. Author

N73-26764# National Research Council of Canada, Ottawa (Ontario).
ELASTIC SCATTERING OF He ON LiF CRYSTAL SURFACES
Atsushi Tsuchida 1973 25 p refs Transl. into ENGLISH from Nippon Kessho Gakkai Shi (Japan), v. 14, 1972 p 17-27
(NRC-TT-1652) Avail: NTIS HC $3.25

The elastic scattering of atomic beams by crystal surfaces is discussed in terms of the interaction potential between He on LiF crystal surfaces. Equipotential curves of He/LiF are presented. F.O.S.

N73-26765# National Bureau of Standards, Washington, D.C. Heat Div.
OPTICAL RADIATION MEASUREMENTS: STABILITY AND TEMPERATURE CHARACTERISTICS OF SOME SILICON AND SELENIUM PHOTODETECTORS
Kshitij Mohan, A. Russell Schaefer, and Edward F. Zalewski Jun. 1973 16 p refs
(NBS-TN-594-5) Avail: SOD $0.35 Domestic Postpaid or $0.25 GPO Bookstore as C13.46:594-5

Some characteristics were compared of selenium barrier layer photocells and silicon PIN and PN type photodiodes operated in the photovoltaic or non biased mode. The work was done to study the suitability of these detectors specifically for goniometric measurements of flux and possibly for other photometric (or radiometric) measurements. The characteristics studied were the stability of detector output approximately twenty hours, fatigue or light memory effects over short periods of time, and the temperature dependence of detector output. Author

N73-26766# Institut fuer Plasmaphysik G.m.b.H., Garching (West Germany).
VARIABLE TEMPERATURE CRYOSTAT FOR STUDYING SUPERCONDUCTORS
W. Amenda Jun. 1972 20 p refs In GERMAN; ENGLISH summary
(IPP-4/95) Avail: AEC Depository Libraries HC $3.00

A metal cryostat inserted in a superconducting magnet (50 mm bore) is described. It is used for studying superconductors in liquid helium below 4.2 K and in gas above 4.2 K. The temperature is kept constant at + or - 0.01 K by a temperature control device with an electrical heater. The sample is measurable at currents of up to several hundred amperes. Author (NSA)

N73-26767*# Chicago Univ., Ill.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF SUPERCONDUCTIVITY. AMORPHOUS SEMICONDUCTORS, SUPERCONDUCTIVITY AND MAGNETISM Final Reports 1 Mar. 1963 - 28 Feb. 1973
Morrel H. Cohen 28 Feb. 1973 21 p refs
(Grants NGR-14-001-009; NGL-14-001-009)
(NASA-CR-133234) Avail: NTIS HC $3.25 CSCL 20L

The research activities from 1 March 1963 to 28 February 1973 are summarized. Major lectures are listed along with publications on superconductivity, superfluidity, electronic structures and Fermi surfaces of metals, optical spectra of solids, electronic structure of insulators and semiconductors, theory of magnetic metals, physics of surfaces, structures of metals, and molecular physics. F.O.S.

N73-26768*# Tuskegee Inst., Ala. Dept. of Physics.
THE PROBLEMS OF GROWTH OF SINGLE CRYSTALS OF RHENIUM AND IRIDIUM DIOXIDES Final Report

17 May 1973 6 p refs
(Grant NGR-01-005-003)
(NASA-CR-133213) Avail: NTIS HC $3.00 CSCL 20B

Research is reported on the following: (1) growth of IrO2 and ReOx by the vapor phase method, in which a measured flow of oxygen gas carries the vapor products of the pure metals from a hot zone to a cold zone in a two temperature zone furnace; and (2) growth of IrO2 and Re2O7 single crystals by the chemical vapor transport method. D.L.G.

N73-26769# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

HELIUM GAS COOLED CURRENT LEADS IN A REFRIGERATOR COOLED SUPERCONDUCTIVE MAGNET SYSTEM

G. Horlitz, S. Wolff, and C. P. Parsch Nov. 1972 18 p refs Presented at 4th Intern. Conf. on Magnet Technol., Upton, N. Y., 19-22 Sep. 1972 Submitted for publication
(DESY-72/65; Conf-720908-33) Avail: AEC Depository Libraries

Operating conditions for large superconductive magnets are maintained by helium refrigerators in closed refrigeration loops. Their current leads are cooled by helium being withdrawn from the gas returning to the cold end of the last heat exchanger of the refrigerator. The cooling gas is warmed up by heat exchange with the current leads and fed back to the main compressor of the refrigerator. The rate of cold gas returning to the refrigerator is reduced and thus the refrigeration power is reduced as well. The refrigeration performance of the magnet-refrigerator system is investigated both theoretically and experimentally by using the excess refrigeration power as a measure for the performance. Author (NSA)

N73-26770# Central Research Inst. for Physics, Budapest (Hungary).

ACTIVATION ANALYTICAL METHODS FOR THE GRADING OF SEMICONDUCTOR CRYSTALS

E. Szabo 1972 13 p refs Presented at Intern. Colloq. on the Activation Anal. of Microquantities of Elem. in Very High Purity Inorganic and Organic Substances and in Biol. Media, Saclay, France, 2-6 Oct. 1972
(Conf-721069-36) Avail: AEC Depository Libraries

The analytical requirements of manufacturing industries are discussed. The results obtained on the bulk, surface, and superficial analysis of semiconductor grade silicon and gallium arsenide are presented. Author (NSA)

N73-26771# Ames Lab., Iowa.

EFFECT OF ALLOYING ON THE SUPERCONDUCTING TEMPERATURE OF La3In

K. A. Gschneidner, Jr., O. D. McMasters, and J. E. Ostenson [1973] 7 p refs Presented at 10th Rare Earth Res. Conf., Carefree, Ariz., 30 Apr. 1973
(IS-M-2; Conf-730402-5) Avail: NTIS

Alloying studies involved: (1) the addition of small nonmetallic elements to La3In (CU3AU-type structure) to form the antiperovskite compounds, (2) the substitution of large metallic elements for lanthanum, and (3) the substitution of small metallic elements for indium. Carbon additions and tin and rare earth (Y,Ce,Gd) substitutions lower the superconducting transition temperature of La3In. Oxygen and silicon additions and aluminum substitutions raise the transition temperature. Within experimental error, boron has no effect. Author (NSA)

N73-26772# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.

MAGNETIC FIELDS DEPENDENCE OF THE MICROWAVE PROPERTIES OF Pb SUPERCONDUCTIVE FILMS, PART 1

E. DiCrescenzo, P. L. Indovina, S. Onori, and A. Rogani 26 Apr. 1972 37 p refs In ITALIAN
(ISS-72/5-Pt-1) Avail: AEC Depository Libraries HC $4.00

Magnetic properties of superconducting films are considered. The problem is the behavior of critical magnetic fields in thin and thick films and also in the more interesting situation when the film thickness is of the same order as the microscopic quantities of the superconductor. In addition to this, the dependence on the film thickness is studied. Measurements are reported on a 15,000 A Pb sample showing the information obtained by means of a high sensitivity differential technique working in the microwave range. Author (NSA)

N73-26773# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.

MAGNETIC FIELD DEPENDENCE OF THE MICROWAVE PROPERTIES OF Pb SUPERCONDUCTIVE FILMS, PART 2

E. DiCrescenzo, P. L. Indovina, S. Onori, and A. Rogani 28 Apr. 1972 35 p refs In ITALIAN
(ISS-72/6-Pt-2) Avail: AEC Depository Libraries $4.00

Magnetic properties of superconducting film are summarized as follows: dependence of the critical magnetic field on the sample thickness; general semiempirical expression valid for any d/lambda(t) ratios; variation of the penetration depth with the film thickness; and study of the order of the phase transition as a function of the magnetic field at various temperatures and sample thickness. Author (NSA)

N73-26774# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

REACTIVE RF AND dc SPUTTERING CRYSTALLINE AND AMORPHOUS VO2 THIN-FILM DEPOSITION

J. Duchene, M. Terraillon, and M. Pailly 21 Sep. 1972 11 p refs Presented at Internatl. Conf. on Thin Films, Venice, 15 May 1972
(CEA-CONF-2133; Conf-720568-2) Avail: AEC Depository Libraries

Experimental conditions for depositing crystalline and amorphous VO2 thin films by RF and dc sputtering are given. Substrate temperature and ion energy are the key parameters to obtain VO2 crystalline deposits at a given oxygen partial pressure. This crystalline VO2 undergoes a semiconductor-to-metal phase transition at 68 C with a resistivity change as high as 1000. The associated hysteresis effect is about 5 C at the transition. The VO2 films with a transition show an increase in resistivity with thickness; amorphous ones are more resistive without any electrical discontinuity. When the crystalline oxide film is coated with another deposit under given thermal deposition conditions, the resistivity jump at 68 C is decreased with a spreading of the hysteresis width. In some cases, the transition becomes quite negligible. Finally, some VO2-film device applications based on the resistivity change (switching) and on the optical index variation at the transition (display) are presented. Author (NSA)

N73-26775# Army Signal Center And School, Fort Monmouth, N.J. Computerized Training System.

VACUUM TUBE AND SOLID STATE CIRCUIT SURVEY Final Technical Report

Albert J. Mizenko and Joseph J. Rich 1 Mar. 1973 27 p (Proj. ABACUS; Proj. COBET)
(AD-759129; CTS-TR-73-1) Avail: NTIS CSCL 05/9

The survey provides information on the proportions of vacuum tube and solid state circuitry currently found in communications-electronics equipment taught in several schools in the US Continental Army Command school system. Projections are made for these proportions two years and five years from the date of the survey. Results show that a substantial proportion of communications-electronics equipment will be vacuum tube operated at least into the early 1980's indicating a continued need for basic electronics training in vacuum tube circuitry during this period. The findings also indicate that any new development of basic electronics instructional material should concentrate on solid state circuitry. Author (GRA)

N73-26776# Honeywell, Inc., Bloomington, Minn. Corporate Research Center.

RESIDUAL STRESSES IN MACHINED MAGNESIUM OXIDE CRYSTALS

Enrique Bernal G. and Barry G. Koepke Apr. 1973 35 p refs (Contract N00014-69-C-0123)
(AD-759411; TR-8) Avail: NTIS CSCL 11/2

The residual stresses introduced in magnesium oxide crystals by grinding on (100) surfaces in -100= directions were measured using photoelastic techniques. Grinding was carried out with two wheels, one removed material by brittle fracture and the other by plastic flow and burnishing. Both wheels introduced a discrete, highly deformed layer adjacent to the machined

surface. In all cases the machined surfaces were under a residual tensile stress which reversed and became compressive within the deformed region. Beneath the deformed layer the residual stress patterns were distinctly different. In crystals ground with the alumina wheel, the stresses reversed again and became tensile within 0.5 mm of the ground surface whereas the subsurface stresses in crystals ground with the diamond wheel remained compressive to distances of 1mm or greater. These different residual stress distributions are discussed in terms of a simple model based on the superposition of mechanically and thermally induced stresses. Author (GRA)

N73-26777# Princeton Univ., N.J. Dept. of Chemistry.
OPTICAL AND MAGNETIC RESONANCE SPECTRA OF INORGANIC MOLECULAR CRYSTALS: URANIUM BOROHYDRIDE (U(BH4)4) IN HAFNIUM BOROHYDRIDE (HF(BH4)4) Technical Report, 28 Feb. - 1 Mar. 1973
Elliot R. Bernstein and Timothy A. Keiderling 2 Apr. 1973 61 p refs
(Contract N00014-67-A-0151-0032; NR Proj. 056-528)
(AD-759371; TR-1) Avail: NTIS CSCL 07/4

The electronic absorption and EPR spectra of U(BH4)4 as a guest in Hf(BH4)4 host crystals are reported. Optical spectra, from the charge transfer or f-to-d cutoff at ca. 2900A to the low energy limit due to host molecular vibrations at ca. 2.0 micrometer, have been obtained at 300, 77, and 2 K for mixed crystals of U(BH4(4Hf(BH4)4 and U(BD4)4/Hf(BD4)4. From temperature effects, deuteration shifts, and intensity patterns, over 20 forced electric dipole crystal field electronic origins have been identified. Several molecular vibrations have been identified built on these origins and based on physically reasonable arguments, are tentatively associated with specific vibrational symmetries and motions of M(BH4)4 type molecules. Calculations, based on a free ion and cubic crystal field parameterized Hamiltonian, are employed to assign electronic origins. Implications of these crystal field and vibrational analyses for actinide spectroscopy are discussed. GRA

N73-26778# Stanford Univ., Calif. Center for Materials Research.
NEW SUPERCONDUCTORS Semiannual Technical Report, 1 Aug. 1972 - 31 Jan. 1973
James P. Collman and William A. Little Mar. 1973 82 p refs
(Contract N00014-67-A-0112-0056; ARPA Order 1681)
(AD-759767; CMR-73-5; SATR-5) Avail: NTIS CSCL 07/2

The report covers work on the study of possible high temperature superconductors. It describes theoretical work on filamentary organo-metallic materials - the conduction mechanism, band theory, and screening; progress towards the synthesis of metallic chain compounds and related organo-metallic complexes, and experimental studies of their solid state properties. Author (GRA)

N73-26779# Army Foreign Science and Technology Center, Charlottesville, Va.
THE PROBLEM OF POLYMORPHOUS METALS AND ALLOYS
E. M. Savitskii 1973 23 p refs Transl. into ENGLISH from the monograph "Metallovedenie Struktura i Suoistva Stalei i Splavov Metallidy, Novye Metody Issledovaniya" Moscow, 1971 p 16-26
(AD-759753; FSTC-HT-23-305-73) Avail: NTIS CSCL 20/2

Industrial technology depends on the utilization of the special physical properties of metals. The phenomenon of polymorphism in metals is in this category. The author discusses what is known about polymorphism. He also emphasizes the need for further research into the subject. He believes that polymorphous materials of many metals can be of great use to modern technology. Author (GRA)

N73-26780# Aerospace Corp., El Segundo, Calif. Lab. Operations.
COORDINATION CHEMISTRY AND KINETICS OF PREFERENTIAL ETCHING ON SURFACE OF TiO2 (RUTILE)
Paul D. Fleischauer and Armond B. Chase 30 Apr. 1973 35 p refs
(Contract F04701-72-C-0073)
(AD-759259; TR-0073(9250-05)-1; SAMSO-TR-73-148) Avail: NTIS CSCL 20/12

Three different types of etch pits were observed on the (001) surfaces of rutile after etching in a KHSO4 flux at temperatures between 400 and 550C. A chemical reaction scheme is presented, which along with a consideration of the surface chemistry of the various crystallographic faces, is used to explain the kinetics of dissolution of the substrate and hence the observed shapes of the etch pits. Etching of a defect is enhanced in surface regions where silver is photochemically deposited and removed prior to the etching. This phenomenon is explained in terms of a hole (or electron) trapping mechanism at a crystal defect. Author (GRA)

N73-26781# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
STRUCTURE, PROPERTIES AND RADIATION SENSITIVITY OF ELECTRICALLY BISTABLE MATERIALS Annual Technical Report, 5 Feb. 1972 - 6 Feb. 1973
Derek B. Dove and Ronald E. Loehman 6 Feb. 1973 30 p refs
(Contract DAHC04-70-C-0024; ARPA Order 1562)
(AD-760335; TR-6) Avail: NTIS CSCL 20/12

The report contains a review of work carried out on the electrical properties of contacts to chalcogenide glasses. The room temperature electrical properties of thin films of glasses have been measured with both sandwich and planar electrode configurations. Conductance and capacitance were measured versus frequency in the two cases as a function of bias voltage. A variation in response was found with bias voltage except in the case of the planar structure with molybdenum electrodes. The variation is quite consistent with a model in which Schottky barriers exist at the electrodes. Measurements of the spectral distribution of noise currents have also been made for the two film configurations under bias and no bias conditions. All devices showed an increase in noise by several orders of magnitude when a biasing voltage was applied. (Author Modified Abstract) GRA

N73-26782# Battelle Columbus Labs., Ohio. Metals and Ceramics Information Center.
SUPERCONDUCTOR MATERIALS. A COMPARISON OF SELECTED STRATEGIC MATERIALS TECHNOLOGIES IN THE US AND USSR
H. D. Moran and K. R. Hanby Apr. 1973 68 p refs
(Contract DSA900-73-C-0922; ARPA Order 2371)
(AD-760330) Avail: NTIS CSCL 20/12

The use of superconductive materials in rotating electrical machinery would permit a considerable reduction in equipment size, which would be especially useful for naval applications. All of the known materials for such applications, however, must be maintained at temperatures below 20K (-253C) in order to keep them in the superconductive state. Materials of construction for equipment used to maintain cryogenic temperatures must be sufficiently ductile at those temperatures to avoid brittle failures in service. Research and development on superconductive machinery, including choice of materials of construction (or development of such materials) is underway in the United States, primarily under sponsorship by ARPA. The objective of the work described in this report was to determine the status of similar work in the U.S.S.R. A survey of Soviet research aimed at discovering materials that are superconductive at temperatures above 20K was included. The method of approach was to survey systematically the recent Soviet literature. GRA

N73-26783# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
REPORT ON THE JOINT SERVICES ELECTRONICS PROGRAM Semiannual Progress Report, 1 Jul. - 31 Dec. 1972
Apr. 1973 75 p refs
(Contracts N00014-67-A-0298-0006; N00014-67-A-0298-0008)
(AD-760008; SAPR-85) Avail: NTIS CSCL 20/12

Contents: Very low frequency wave propagation; Electron and solid state physics; Control theory and applications; Electronic circuits and instrumentation; Electromagnetic phenomena: (antennas, coupled antennas and arrays, antennas and waves in

dielectric, conducting, and plasma media, antennas and transmission lines). GRA

N73-26784# Texas Univ., Austin.
AMORPHOUS SEMICONDUCTORS Semiannual Technical Report, 1 Oct. 1972 - 31 Mar. 1973
James C. Thompson 31 Mar. 1973 27 p refs
(Grant DA-ARO(D)-31-124-72-G75; ARPA Order 1562)
(AD-759849) Avail: NTIS CSCL 20/12

Attention is directed toward the mechanical properties of amorphous semiconductors, specifically at high pressure. As one facet of this investigation, the isothermal compressibilities of Te15Ge3As2, Te15Ge2As3, and As2Se3 have been measured to 5kbar. GRA

N73-26785# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
AN EXPERIMENTAL STUDY OF ULTRAHIGH FLUENCE OXYGEN ION IMPLANTATION IN SILICON
C. B. Fite and W. W. Grannemann May 1973 78 p refs
(Contract N00014-68-A-0158)
(AD-760350; EE-204(73)ONR-005) Avail: NTIS CSCL 09/1

An investigation was made to determine the feasibility of using ultrahigh fluences of implanted oxygen ions to create a usable oxide layer on silicon for device applications. This investigation included structural studies of observable surface defects which serve to illustrate the large amounts of stress induced in the implanted silicon. Measurements of the surface profile which manifest the effects of surface sputtering and lattice expansion were made. In addition, etch studies are reported in which implanted samples were etched in successive steps to determine how the structure of the implanted layer varied as a function of depth from the surface. (Author Modified Abstract) GRA

N73-26786# Office of Naval Research, London (England).
SUPERCONDUCTIVITY RESEARCH IN DENMARK
Edgar A. Edelsack 16 Apr. 1973 14 p refs
(AD-760317; ONRL-11-73) Avail: NTIS CSCL 20/12

There are three main universities in Denmark: Copenhagen, Aarhus, and Odense, and the Technical University at Lyngby. The report describes low temperature research being carried out at each of these universities. Author (GRA)

N73-26787# Michigan Univ., Ann Arbor. Electron Physics Lab.
MICROWAVE SOLID-STATE DEVICE AND CIRCUIT STUDIES Technical Report, 1 Jun. - 1 Dec. 1972
G. I. Haddad Mar. 1973 139 p refs
(Contract F30602-71-C-0099; AF Proj. 5573)
(AD-759833; Rept-037250-8/9; RADC-TR-73-60) Avail: NTIS CSCL 09/1

This is the eighth and ninth quarterly report on subject contract whose objectives are to investigate theoretically and experimentally new solid-state phenomena and techniques having application to microwave generation, amplification, and control. Current tasks under this program are: Power combining schemes for solid-state devices, Modulation properties of Gunn-effect devices, Avalanche-diode amplifiers, Operating characteristics of IMPATT diodes, High-efficiency avalanche diodes. Properties of TRAPATT diodes, Field-effect transistors, and Solid-state device fabrication. Author (GRA)

N73-26788# Whittaker Corp., Waltham, Mass. Space Sciences Div.
INVESTIGATION OF THE PROPERTIES OF THIN INSULATING FILMS DEPOSITED WITH AN ION BEAM SYSTEM Final Report, 1 May - 31 Jul. 1972
Sol Aisenburg and Ronald W. Chabot Jan. 1973 29 p refs
Sponsored in part by Defense Nuclear Agency
(Contract F19628-72-C-0291; AF Proj. 5710)
(AD-760118; SSD-P-686-FR; AFCRL-TR-73-0176) Avail: NTIS CSCL 20/12

A preliminary study is described wherein thin film insulators deposited with a unique ion beam deposition system were investigated for radiation resistance. Metal-insulator-semiconductor structures were fabricated and used to evaluate both an insulating carbon film and ion beam deposited Al2O3 films. I-V and C-V measurements are described for both types of materials for eventual application in field effect devices. These showed little shift in flat-band voltage under irradiation, however, some surface charge effects require further study. Author (GRA)

N73-26789# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
RESISTIVITY AND CARRIER LIFETIME IN GOLD-DOPED SILICON Final Report, 1 Jan. - 31 Dec. 1972
W. Robert Thurber, David C. Lewis, and W. Murray Bullis 31 Jan. 1973 55 p refs
(PRO-Y-72-873; AF Proj. 6096)
(AD-760150; AFCRL-TR-73-0107) Avail: NTIS CSCL 20/12

The report describes the current status of a continuing study of the electrical properties of gold-doped silicon. Room temperature resistivity and Hall effect measurements were made on many sets of gold-diffused boron- or phosphorus-doped silicon wafers for a wide range of initial resistivities of both types. The general suitability of the proposed model was verified although an apparent discrepancy still remains between total and electrically active gold as confirmed by resistivity data as a function of gold density for phosphorus-doped silicon. Electrical measurements were made to study the activation energies of the gold donor and acceptor. In addition the activation energy of the gold-coupled shallow acceptor in the proposed model was observed. (Author Modified Abstract) GRA

N73-26790# Northrop Corporate Labs., Hawthorne, Calif.
RADIATION EFFECTS ON SEMICONDUCTOR MATERIALS AND DEVICES Final Report, 8 Feb. - 8 Dec. 1972
Joseph R. Srour, Siegfried Othmer, and Orlie L. Curtis, Jr. Mar. 1973 210 p refs
(Contracts DAAG39-69-C-0039; DAAG39-73-C-0019; HDL Proj. 235227)
(AD-759946; NRTC-72-16R; HDL-039-3) Avail: NTIS CSCL 09/1

Techniques are described for obtaining recombination-center parameters from carrier lifetime studies. Studies of recombination at disordered regions include damage comparisons for fusion- and fission-neutron-irradiated bulk silicon and silicon solar cells, and diffusion length measurements in neutron-irradiated silicon and gallium arsenide. Short-term annealing investigations include the development of expressions for evaluating early-time damage ratios and studies of transient recovery in bulk silicon, silicon solar cells, and bipolar transistors following bursts of both 14-MeV and reactor neutrons. Measurement techniques are described for determining drift mobility in heavily irradiated silicon and for determining the injection-level dependence of lifetime in semiconductors. GRA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-26791# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Trauen (West Germany). Abteilung feststoffe.
EXPERIMENTAL INVESTIGATION ON THE POSSIBLE APPLICATION OF A BORON/LITHIUM SYSTEM AS PROPELLANT COMPONENT OF AIR-AUGMENTED ROCKETS [EXPERIMENTELLE UNTERSUCHUNGEN UEBER DIE MOEGLICHE VERWENDUNG EINES BOR/LITHIUM-SYSTEMS ALS TREIBSTOFFKOMPONENTE IN KOMBINATIONSANTRIEBEN]
Rolf Mestwerdt and William H. McLain 6 Dec. 1972 29 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-73-08) Avail: NTIS HC $3.50; DFVLR Porz-Wahn: 8,50 DM

A test program was performed to investigate the possibility of forming a boron/lithium compound to be used as a propellant additive in a hybrid rocket engine. In particular, the physical, chemical, and thermodynamic properties of the reaction product were observed. The reaction enthalpy for the binary boron/lithium

system was measured for B/Li atomic ratios between 0.33 and 12, and the reaction product density for atomic ratios between 1.5 and 6.0. Wet analyses indicated that two products were formed during reaction: a compact substance and a fine granular powder, possibly consisting of boron. ESRO

N73-26792# Naval Postgraduate School, Monterey, Calif.
VISCOELASTIC ANALYSIS METHOD FOR ROCKET MOTORS CONTAINING CRACKS
Gerald H. Lindsey Mar. 1973 60 p refs
(AD-759968; NPS-57LI73031A) Avail: NTIS CSCL 21/9

The basic definitions for viscoelastic stress intensity factors are set forth with associated computations for determining them in laboratory specimens. Laboratory tests have been conducted to characterize propellants fracture-wise, and the most suitable test found was the long strip subjected to a constant force loading. The influence of dewetting on the fracture characterization appears to be significant, but the matter has not yet been fully resolved. An approximate method for performing viscoelastic fracture analyses has been presented which incorporates the a fore mentioned fracture characterization. It requires minimum computer usage and should yield good results. Author (GRA)

N73-26793# Army Coating and Chemical Lab., Aberdeen Proving Ground, Md.
VANADIUM AND NICKEL COMPLEXES IN PETROLEUM DISTILLATES
Marjan Kolobielski May 1973 18 p refs
(DA Proj. 1T0-62105-A-329)
(AD-760462; CCL-3001) Avail: NTIS CSCL 21/4

The presently existing federal specifications for distillate fuels used in motor vehicles give only broad limits of fuel properties. It is possible that a given fuel shipment will conform to the specification requirements but may cause malfunction of the engine because of the existence in the fuel of trace contaminants, in parts per million concentration range. One of the significant potentially harmful materials are metallo-organic compounds, particularly vanadium and nickel complexes. The complexes originated in the crude and still may be present in the distillates in spite of the processing in the refinery. The report presents a literature survey which describes the nature, properties and harmful effects of vanadium and nickel complexes and explains their presence in the distillates. Only those articles were selected which pertain to the understanding of the relationship between these fuel contaminants and malfunction of the motor vehicle. GRA

N73-26794# Georgia Inst. of Tech., Atlanta.
COMPLEX METAL HYDRIDES. HIGH ENERGY FUEL COMPONENTS FOR SOLID PROPELLANT ROCKET MOTORS Annual Report, 1 Mar. 1972 - 28 Feb. 1973
Eugene C. Ashby 11 May 1973 169 p refs
(Contract N00014-67-A-0159-0005; NR Proj. 093-050)
(AD-760346) Avail: NTIS CSCL 07/2

The report discusses research conducted during the fifth contract period. Work has continued on the preparation and structure elucidation of simple and complex metal hydrides of the main group elements. Projects completed during the past year are (1) a study of the reactions of LiAlH4 and NaAlH4 with BeCl2 in ether and THF. This study answers the questions about the existence of Be(AlH4)2 and the study further established a significant amount of beryllium-hydrogen chemistry, (2) a study of the redistribution of AlH3-BeCl2, BeH2-BeCl2 and AlH3-AlCl3 in ether solvent, (3) a study of the formation and properties of ether soluble AlH3 (4) a study involving the preparation of a series of complex metal hydrides of zinc (e.g., Li2ZnH4), (5) a study concerning the preparation of (ate) complexes and complex metal hydrides of cadmium and mercury, and (6) a manuscript was prepared for J. Chem. Ed. describing A Glove Box System for the Preparation of Air Sensitive Compounds. (Author Modified Abstract) GRA

N73-26972 National Research Council of Canada, Ottawa (Ontario). Fuels and Lubricants Lab.
JET FUEL SPECIFICATIONS
L. Gardner and R. B. Whyte *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeronaut. Est. 31 Mar. 1973 p 21-34 refs (For availability see N73-26970 17-34)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-26795*# TRW Systems Group, Redondo Beach, Calif.
ELECTROSTATIC PROPULSION BEAM DIVERGENCE EFFECTS ON SPACECRAFT SURFACES. VOLUME 2, ADDENDUM 1: ION TIME-OF-FLIGHT DETERMINATIONS OF DOUBLY TO SINGLY IONIZED MERCURY ION RATIOS FROM A MERCURY ELECTRON BOMBARDMENT DISCHARGE Final Report
J. M. Sellen, Jr., R. F. Kemp, and David D. Hall 19 Apr. 1973 48 p refs 2 Vol.
(Contracts NAS7-100; JPL-952350)
(NASA-CR-131841; TRW-11985-6002-RU-01-Vol-2-Add) Avail: NTIS HC $4.50 CSCL 21C

The analysis of ion exhaust beam current flow for multiply charged ion species and the application to propellant utilization for the thruster are discussed. The ion engine in use in the experiments is a twenty centimeter diameter electromagnet electron bombardment engine. The experimental technique to determine the multiply charged ion abundance ratios using ion time of flight is described. An analytical treatment of the discharge action in producing various ion species has been carried out. Author

N73-26796*# General Electric Co., Cincinnati, Ohio.
PRELIMINARY DESIGN STUDY OF QUIET INTEGRAL FAN LIFT ENGINES FOR VTOL TRANSPORT APPLICATIONS IN THE 1980s Final Report
G. R. Rabone and E. Paulson Jun. 1973 280 p
(Contract NAS3-14404)
(NASA-CR-120969) Avail: NTIS HC $16.00 CSCL 21E

Preliminary designs of three integral lift fan engines suitable for commercial certification in the 80's were completed. Emphasis was placed on low cost, simplicity, low noise, low emissions, minimum weight, and design features meeting all commercial standards for fire safety and containment. Author

N73-26797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED TECHNOLOGY FOR REDUCING AIRCRAFT ENGINE POLLUTION
Robert E. Jones 1973 22 p refs Proposed for presentation at Winter Ann. Meeting of the ASME, Detroit, 11-15 Nov. 1973
(NASA-TM-X-68256; E-7537) Avail: NTIS HC $3.25 CSCL 21B

Combustor research programs are described whose purpose is to demonstrate significantly lower exhaust emission levels. The proposed EPA regulations covering the allowable levels of emissions will require a major technological effort if these levels are to be met by 1979. Pollution reduction technology is being pursued by NASA through a combination of in-house research, contracted programs, and university grants. In-house research with the swirl-can modular combustor and the double-annular combustor has demonstrated significant reduction in the level of NO(x) emissions. The work is continuing in an attempt to further reduce these levels by improvements in module design and in air-fuel scheduling. Research on the reduction of idle emissions has included the conversion of conventional duplex fuel nozzles to air-assisted nozzles and exploration of the potential improvements possible with fuel staging and variable combustor geometry. Author

N73-26798*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTROMAGNETIC INTERFERENCE OF POWER CONDITIONERS FOR SOLAR ELECTRIC PROPULSION
A. C. Whittlesey and T. W. Macie 1 Jul. 1973 42 p refs
(Contract NAS7-100)
(NASA-CR-133229; JPL-TM-33-623) Avail: NTIS HC $4.25

CSCL 21C

Electrical, multikilowatt power conditioning (PC) equipment needed on board a spacecraft utilizing solar electric propulsion creates an electromagnetic environment that is potentially detrimental to the science, navigation, and radio communication hardware. Within the scope of the solar electric propulsion system technology program, three lightweight, 2.5-kW PCs were evaluated in terms of their electromagnetic characteristics. It was found that the levels of radiated and conducted interference exceeded the levels anticipated for a solar electric propulsion mission. These noise emissions, however, were the result of deficient interference design in these models, rather than a basic inability to control interference in this type of PC. Author

N73-26799*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

STATISTICAL ERROR MODEL FOR A SOLAR ELECTRIC PROPULSION THRUST SUBSYSTEM

M. H. Bantell 1 Jun. 1973 37 p refs

(Contract NAS7-100)

(NASA-CR-133232; JPL-TM-33-607) Avail: NTIS HC $4.00 CSCL 21C

The solar electric propulsion thrust subsystem statistical error model was developed as a tool for investigating the effects of thrust subsystem parameter uncertainties on navigation accuracy. The model is currently being used to evaluate the impact of electric engine parameter uncertainties on navigation system performance for a baseline mission to Encke's Comet in the 1980s. The data given represent the next generation in statistical error modeling for low-thrust applications. Principal improvements include the representation of thrust uncertainties and random process modeling in terms of random parametric variations in the thrust vector process for a multi-engine configuration. Author

N73-26800# Advisory Group for Aerospace Research and Development, Paris (France).

MODERN METHODS OF TESTING ROTATING COMPONENTS OF TURBOMACHINES

M. Pianko, ed. (Serv. Tech. Aeronaut., Paris) May 1973 51 p refs Partly in ENGLISH, partly in FRENCH Conf. held at Toulouse, 18-21 Sep. 1972

(AGARD-AG-167; AGARDograph-167) Avail: NTIS HC $4.75

The AGARD Propulsion and Energetics Panel conducted a survey on the methods used to test the rotating components of turbomachines. The objective was to assess the advantages and usefulness of the so-called elementary tests, compared with the tests conducted on complete turbomachines. Based on a detailed analysis of the answers received from the questionnaires, and an exchange of views among the experts appointed by the Panel, general conclusions are presented on the value and use of cascade test data; testing and measuring equipment for cascade tests; testing techniques for supersonic compressor cascade; tests on compressor or turbine stage(s), and on a complete compressor or turbine; Reynolds number effects; cold testing of turbines; and compressor stability and distortion tests. Author

N73-26801*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

APOLLO 15 MISSION REPORT. SUPPLEMENT 3: ASCENT PROPULSION SYSTEM FINAL FLIGHT EVALUATION

W. G. Griffin Sep. 1972 61 p refs Prepared by TRW Systems

(Contract NAS9-12330)

(NASA-TM-X-69204; MSC-05161-Suppl-3) Avail: NTIS HC $5.25 CSCL 21H

The results are presented of the postflight analysis of the ascent propulsion system (APS) performance during the Apollo 15 Mission. The information presented includes: (1) calculated performance values for the APS lunar liftoff burn; (2) discussion of analysis techniques, problems and assumptions; (3) comparison of postflight analysis and preflight prediction; (4) reaction control system (RCS) duty cycle included in the APS performance analysis; (5) transient performance analysis; and (6) the APS propellant consumption values. Author

N73-26802# Los Alamos Scientific Lab., N.Mex.

DART TECHNOLOGY DEVELOPMENT Final Report

K. C. Cooper and W. C. Turner Dec. 1972 40 p refs

(Contract W-7405-eng-36)

(LA-5017-MS) Avail: NTIS HC $4.00

Technology development for a Decomposed Ammonia Radioisotope Thruster (DART) of 0.01 to 0.1 lb thrust is reported. Design, materials and fabrication, and testing results are presented. Assembly of a rhenium heat exchanger, including nozzles and inlet tubes, was accomplished with electron beam welding. A useful series of molybdenum-rhenium alloys with from 20 to 46 wt % rhenium was prepared, using electron beam melting for purity. Molybdenum foam was brazed to molybdenum sheet. Diffusion couples were tested at operating conditions, and compatibility for 500 h was established between: carbon vs beryllia, carbon vs tungsten, iridium vs molybdenum-rhenium, zirconia vs tungsten, zirconia vs molybdenum, hafnia vs tungsten, and hafnia vs molybdenum. Author (NSA)

N73-26803# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.

DIRECT THRUST MEASUREMENTS ON AN ELECTROSTATIC GAS DISCHARGE ION THRUSTOR Ph.D. Thesis - Brunswick Univ.

Hinrich J. Junge 19 Dec. 1973 129 p refs In GERMAN; ENGLISH summary

(DLR-FB-73-48) Avail: NTIS HC $8.50; DFVLR, Porz, West Ger. 21 DM

Using a particular thrust dynamometer suspended by critically loaded columns, direct thrust measurements on the mercury electron bombardment ion thruster ESKA 18 P were carried out. The results demonstrate that in the whole range of thruster performance the effective thrust is considerably lower than the nominal thrust calculated from ion beam current and acceleration voltage. The difference between nominal and effective thrust shows a dependence upon the acceleration voltage; the thrust loss is about 15 percent of the effective thrust at 0.8 kV and decreases to 6 percent at 2.1 kV. The main reasons for the measured thrust deviation in accordance with diagnostic investigations in the U.S. are the partially double ionization of mercury as well as the beam divergence, and an influence of the residual gas in the vacuum chamber. Author (ESRO)

N73-26804# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SELF-ADJUSTING CLOSED DIGITAL SYSTEM FOR THE PROGRAMMED CONTROL OF THE FINISHING OF TURBINE BLADES

L. S. Yampolskii 13 Apr. 1973 13 p ref Transl. into ENGLISH from Mekhaniz. i Avtomatiz. Upr. (Kiev), no. 4, 1968 p 23-26 (AF Proj. 3066)

(AD-759682; FTD-HT-23-215-73) Avail: NTIS CSCL 21/5

At the Sevastopol:skiy Instrument Making Institute a closed digital system has been developed for the programmed control of the process of machining the foil of turbine blades of the high and medium pressure stages on machine tools which are equipped with electric drives. Control of the movements of the working elements of the machine tool is realized by a program which is written on a six-track magnetic tape. GRA

N73-26805# Ohio State Univ. Research Foundation, Columbus.

TRANSPIRATION COOLING. PART 1: ANALYTICAL MODEL Final Report, 1 Jan. 1970 - 30 Nov. 1972

L. E. Winget and L. S. Han Dec. 1972 430 p refs

(Contract F33615-70-C-1331; OSURF Proj. 2977)

(AD-759190; AFAPL-TR-73-11-Pt-1) Avail: NTIS HC $9.55/set of 3 reports as AD-759190-set CSCL 21/5

An analytical method is presented for investigation of transpiration cooling and the downstream cooling effects beyond the point of discontinuous blowing. The method presented is restricted to the laminar regime. An integral method which satisfies the first two compatibility conditions at the wall is developed for both the velocity and thermal boundary layers. An exponential function is incorporated for both the velocity and temperature fields. The boundary layer definition is extended through the position of discontinuous blowing to the point of separation. The wall temperature is assumed constant in the transpiration regime and is allowed to vary downstream from the permeable

wall to evaluate the effects of downstream cooling. Asymptotic expressions are given for both large blowing and suction velocities. (Author Modified Abstract) GRA

N73-26806# Ohio State Univ. Research Foundation, Columbus.
TRANSPIRATION COOLING. PART 2: EXPERIMENTAL STUDY OF WAKE EFFECTS Final Report, 1 Jan. 1970 - 30 Nov. 1972
Leon E. Winget and L. S. Han Mar. 1973 120 p refs
(Contract F33615-70-C-1331; AF Proj. 3066; OSURF Proj. 2977)
(AD-759191; AFAPL-TR-73-11-Pt-2) Avail: NTIS HC $19.55/set of 3 reports as AD-759190-set CSCL 21/5

An experimental analysis is presented for the investigation of the stator wake effects on the rotor blades which are immediately downstream. A two-dimensional test apparatus is used to simulate the stator and rotor blades. The test section is 2 x 2 feet. The chord length of the test blades is 7 inches. All Reynolds number range is from 100,000 to 200,000. Static pressure readings are recorded along the surface of the rotor test blade as well as a pressure traverse behind the stator blades. The second row of blades are movable with respect to the first row to simulate various positions of the wake interaction. The boundary layer growth is computed by the integral method presented in Part I and compared with another method presented in a recent NASA report, (NASA TN-D-5681 (McNally, 1970)). (Author Modified Abstract) GRA

N73-26807# Ohio State Univ. Research Foundation, Columbus.
TRANSPIRATION COOLING. PART 3: USER'S MANUAL Final Report, 1 Jan. 1970 - 30 Nov. 1972
Leon E. Winget and L. S. Han Mar. 1973 191 p
(Contract F33615-70-C-1331; AF Proj. 3066; OSURF Proj. 2977)
(AD-759192; AFAPL-TR-73-11-Pt-3) Avail: NTIS HC $19.55/set of 3 reports as AD-759190-set CSCL 21/5

The computer program is presented for obtaining the drag and heat transfer coefficients around an airfoil with a blunt leading edge. The surface may be impermeable or porous with a specified blowing incorporating exponential profiles for both the velocity and temperature fields. The method has the capability of integrating around a body to the point at which the flow field separates from the surface. Provisions are included to handle the case of discontinuous blowing. In addition, any body for which the initial length can be approximated by the flat plate similarity solution can be analyzed. Author (GRA)

N73-26808# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY AND CALCULATION OF FEED UNITS OF LIQUID-PROPELLANT ROCKET ENGINES
B. V. Ovsyannikov and B. I. Borovskii 28 Feb. 1973 774 p refs Transl. into ENGLISH from the monograph "Teoriya i Raschet Agregtov Pitaniya Zhidkostnykh Raketnykh Dvigatelei" Moscow, 1971 p 1-540
(AD-760265; FTD-MT-24-1524-72) Avail: NTIS CSCL 13/11

In the book information on the theory and hydraulic design of pumps and turbines of turbopump units (TU) (THA) of liquid-propellant rocket engines (LPRE) is given. Principles of the general theory of vane machines are given. The basic calculated relations for the design of the flow part of pumps and turbines are derived. The selection of the basic parameters of turbopump units is substantiated, and conditions of their operation are analyzed. Methods of the calculation of pumps and turbines of LPRE are briefly set forth. Examples of the calculation are given. GRA

N73-26809# Purdue Univ., Lafayette, Ind.
PROJECT SQUID Semiannual Progress Report, 1 Oct. 1972 - 30 Mar. 1973
T. C. Adamson, Jr., F. Carta, P. Chung, J. Daiber, and F. Fendell 1 Apr. 1973 99 p refs
(Contract N00014-67-A-0225-0005; NR Proj. 098-038)
(AD-759977) Avail: NTIS CSCL 21/5

Reports of progress during the past six months on the 16 research programs comprising Project SQUID are presented. The research programs fall into the areas of Fluid Mechanics, Atomic and Molecular Collisions, Measurement Techniques, and Combustion and Chemical Rate Processes. Project SQUID is a cooperative program of basic research related to jet propulsion. It is administered by Purdue University and sponsored by the Office of Naval Research. Author (GRA)

N73-26810# Battelle Columbus Labs., Ohio. Metals and Ceramics Information Center.
SILICON NITRIDE FOR GAS TURBINE APPLICATIONS. A COMPARISON OF SELECTED STRATEGIC MATERIALS TECHNOLOGIES IN THE US AND USSR
H. D. Moran and K. R. Hanby Apr. 1973 20 p refs
(Contract DSA900-73-C-0922; ARPA Order 2371)
(AD-760329) Avail: NTIS CSCL 21/5

Gas turbine engines operating at inlet temperatures of 2500F or higher would be much more efficient than comparable present engines, which are limited by their materials of construction to a maximum inlet temperature of 2000F. The promise of higher efficiency has stimulated U.S. and British research on ceramic engines; because of its desirable properties, silicon nitride has been chosen as the primary material to be evaluated for engine applications in programs at Ford and Westinghouse. The objective of the work described in this report was to determine whether or not ceramic-engine development involving silicon nitride was also being pursued in the Soviet Union, and, if so, to evaluate the Soviet program. The method of approach was a survey of Soviet literature. GRA

N73-26811# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF STATISTICAL METHODS TO THE DETERMINATION OF VIBRATIONAL INTENSITY IN TURBOMACHINE BLADES AND TO THE EVALUATION OF THEIR RELIABILITY
L. A. Kozlov and Yu. M. Khalatov 27 Apr. 1973 10 p Transl. into ENGLISH from the publ. "Problemy Nadezhnosti v Stroitelnoi Mekhanike" USSR, Jun. 1968 p 257-261
(AF Proj. 782)
(AD-760279; FTD-HT-23-230-73) Avail: NTIS CSCL 21/5

The report presents a statistical analysis of vibrational intensity in turbomachine blades, the results of which can be used to calculate strength and to determine reliability. GRA

N73-26812# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE LIFE OF TURBINE BLADES OPERATING UNDER STOCHASTIC CONDITIONS
B. A. Gryaznov and A. S. Tugarinov 4 May 1973 15 p refs Transl. into ENGLISH from the monograph "Problemy Nadezhnosti v Stroitelnoi Mekhanike" Jun. 1968 p 252-257
(AD-759874; FTD-HT-23-229-73) Avail: NTIS CSCL 21/5

The paper is devoted to an experimental study of the life of turbine blades under stochastic conditions of operation. The studies were made with the help of a UL-1 resonance unit (1). Fatigue tests were made on blades at constant room and high temperatures, and also with cyclic changes of temperature. Author (GRA)

N73-26813# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.
RESEARCH ON THE FLUTTER OF AXIAL-TURBOMACHINE BLADING
Fernando Sisto and P. V. K. Perumal 2 May 1973 40 p refs
(Contract N00014-67-A-0202-0016; NR Proj. 094-363)
(AD-760354; ME-RT-73003) Avail: NTIS CSCL 21/5

An analytical method for predicting the perturbed aerodynamic reactions of a harmonically oscillating flat plate airfoil with time dependent point of separation is presented. It is shown that this method in conjunction with an empirical knowledge of the time history of the separation point can predict stall flutter. Numerical results are presented and compared with existing theoretical and experimental results. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-26814 California Univ., San Diego.
DEPTH PROFILES OF GALACTIC COSMIC RAY PRODUCED RADIONUCLIDES IN LUNAR SAMPLES Ph.D. Thesis
Robert Charles Finkel 1972 162 p
Avail: Univ. Microfilms Order No. 72-33082

The concentrations of several cosmogenic radionuclides as a function of depth were analyzed by radiochemical means in lunar samples from the Apollo missions. A chemical separation procedure, which relied heavily on ion exchange techniques, was used to separate the following elements from samples of lunar soil and rock: Be, Na, Al, Cl, V, Mn, Fe, Co, and Ni. This procedure and the subsequent radiochemical purification of these elements is described. Atomic absorption techniques for monitoring the separative procedure and for analyzing the lunar materials are discussed. Dissert. Abstr.

N73-26815 Yale Univ., New Haven, Conn.
THE POLARIZATION OF COSMIC-RAY MUONS Ph.D. Thesis
Richard James Turner 1972 56 p
Avail: Univ. Microfilms Order No. 73-377

The polarization of cosmic ray muons arriving at sea level with different energies and from different zenith angles was measured. The polarization of positive muons from the zenith with energies near 1.0 GeV was found to be + or - 0.33 0.04, where the polarization in the direction of flight was measured and the negative sign indicates that the spin was antiparallel to the direction of flight. Muons from the zenith with energies near 3.5 GeV at sea level had polarizations of + or - 0.38 0.04, and the polarization of muons with energies near 4.5 GeV incident at an angle of 45 deg with the zenith was found to be + or - 0.34 0.04 These polarizations are consistent with the polarizations calculated on the basis that the muons are derived almost wholly from the decay of pions produced by the interaction of primary and secondary cosmic-ray hadrons with the nuclei of the atmosphere. Dissert. Abstr.

N73-26816 Houston Univ., Tex.
TERMINAL FLOW OF THE SOLAR WIND Ph.D. Thesis
Cary Lloyd Semar 1972 81 p
Avail: Univ. Microfilms Order No. 73-330

The shock front shape which terminates the solar wind is calculated by assuming the streamlines in the subsonic flow region are the same as for an incompressible irrotational flow. A minimum ratio of stagnation to shock distance of 1.57 was found. Solutions which include the effect of photoionization of the interstellar medium were obtained by integrating the equations of the flow along the streamlines. A shock distance of 75 AU was obtained. The solutions were found to behave as predicted by previous workers on the basis of momentum-pressure balancing. Dissert. Abstr.

N73-26817*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESULTS ON THE ENERGY DEPENDENCE OF COSMIC RAY CHARGE COMPOSITION
V. K. Balasubrahmanyan and J. F. Ormes May 1973 16 p refs
(NASA-TM-X-66136; X-661-72-447) Avail: NTIS HC $3.00 CSCL 03B

Measurements using a balloon-borne ionization spectrometer on the differential energy spectra of the heavy nuclei of the galactic cosmic radiation are reported. The spectra of individual elements up to oxygen and groups of nuclei up through iron were measured up to almost 100 GeV/nucleon. The energy spectrum of the secondary nuclei, B+N, is steeper than that of the primary nuclei, C+O, by gamma = 0.21 + or - .09 in agreement with other authors. The spectral shapes found are reasonably well represented by single power laws between 2 and 60 GeV/nucleon. Data are consistent with the decrease in the secondary to primary ratio found by others above 20 GeV/nucleon, but it shows no evidence for any sudden change in this ratio within counting statistics. The most dramatic finding is that the spectrum of the iron nuclei is flatter than that of the carbon and oxygen nuclei by 0.57 + or - 0.14 of a power. The experimental techniques for charge and energy determination are presented and corrections due to nuclear disintegration and losses of energy out the bottom of the spectrometer are discussed. Author

N73-26818*# Maryland Univ., College Park. Dept. of Mechanical Engineering.
AN ASSESSMENT OF SOLAR ENERGY AS A NATIONAL ENERGY RESOURCE
Paul Donovan, William Woodward, William E. Cherry, Frederick H. Morse, and Lloyd O. Herwig Dec. 1972 89 p refs Sponsored by NASA and NSF
(NASA-CR-133101) Avail: NTIS HC $6.50 CSCL 10A

The applications are discussed of solar energy for thermal energy for buildings; chemical and biological conversion of organic materials to liquid, solid, and gaseous fuels; and the generation of electricity. It is concluded that if solar development programs are successful, building heating for public use is possible within 5 years, building cooling in 6 to 10 years, synthetic fuels from organic materials in 5 to 8 years, and electricity production in 10 to 15 years. F.O.S.

N73-26819*# Techtran Corp., Glen Burnie, Md.
COSMIC RAYS IN THE EARTH'S MAGNETIC FIELD
L. I. Dorman, V. S. Smirnov, and M. I. Tyasto Washington NASA May 1973 440 p refs Transl. into ENGLISH of the book "Kosmicheskiye Luchi v Magnitnom Pole Zemli" Moscow, Nauka Press, 1971
(Contract NASw-2037)
(NASA-TT-F-756) Avail: NTIS HC $6.00 CSCL 03B

Studies are presented of the behavior of cosmic rays in the earth's magnetic field. It discusses the theory of motion of charged particles in an idealized field model and presents results of trajectory calculations of asymptotic directions and cutoff rigidities in a real field with consideration of higher harmonics of the Gaussian series from internal field sources and with consideration of the influence of extraionosphere current systems and of the magnetosphere tail on cosmic rays. In addition, temporal variations of the cosmic ray flux due to changes of the magnetosphere under the influence of the solar wind are investigated. A systematic survey is given of the enormous accumulated experimental material based on data of measurements with ground based instruments, balloons, and satellites and the influence of the earth's magnetic field on cosmic rays. A detailed analysis of this material is made within the scope of present-day theory and present-day model representations. Author

N73-26820*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
A SEARCH FOR PERIODIC STRUCTURE IN SOLAR 2 cm MICROWAVE RADIATION Ph.D. Thesis
Davis D. Sentman May 1973 86 p refs
(Grant NGL-16-001-002; Contract N00014-68-A-0196-0003)
(NASA-CR-133228; U-of-Iowa-73-20) Avail: NTIS HC $6.50 CSCL 03B

A power spectral analysis of 285 hr of 2 cm microwave intensity data showed no statistically significant (> 96% confidence) periodicities in the frequency range 1 to 15 mHz. No correlation was found between 2 cm periodicities and solar activity in H alpha, X-ray, and several microwave frequencies. A small shift of power toward higher frequencies in the power spectrum of the 2 cm data was found to be correlated with solar H alpha and X-ray activity. Using the statistical properties of power spectra, an expression for the ratio of the minimum detectable peak-to-peak to ambient temperature at chromospheric heights may be derived. Applied to a model for oscillation bursts in quiescent supergranules, and using the most significant results of experiments to detect the microwave periodicities, this expression yields an upper limit of approximately .0015. Author

N73-26821*# Scientific Translation Service, Santa Barbara, Calif.
SOLAR ACTIVITY AND PHENOMENA IN THE BIOSPHERE

M. N. Gnevyshev and K. F. Novikova Washington NASA Jul. 1973 10 p Transl. into ENGLISH from Zemlya i Vselennaya (USSR), no. 4, 1971 p 33-36
(Contract NASw-2483)
(NASA-TT-F-14984) Avail: NTIS HC $3.00 CSCL 03B

The influence of solar activity on the biosphere is proven by the correlation between the indices of activity or geomagnetic disturbances, with the biological indices, as well as by direct experiments. In the case of the latter, the biological objects, which are located in an artificial variable electromagnetic field (similar to the field of geomagnetic disturbances) are compared with objects outside of it. Both types of proof yield results which closely coincide. Author

N73-26822*# California Inst. of Tech., Pasadena. Div. of Physics, Mathematics, and Astronomy.
SURFACE BRIGHTNESS MEASUREMENTS OF SUPERNOVA REMNANTS IN THE ENERGY BAND 0.15 - 4 keV AND AN XUV SURVEY FROM AN ALTITUDE CONTROLLED ROCKET Final Report, 1 May 1971 - 31 Mar. 1973
Gordon P. Garmire and Guenter Riegler 31 Mar. 1973 77 p refs
(Grant NGR-05-002-219)
(NASA-CR-133098) Avail: NTIS HC $6.00 CSCL 03B

Reports are presented concerning the flight of Aerobee 170, 13.063 UG. The papers presented include: soft X-rays for Cygnus X-1 and Cygnus X-2; X-ray spectrum of the entire Cygnus loop; X-ray surface brightenss of the Cygnus loop; and observations of He II 304 A and He I 584 a nightglow. F.O.S.

N73-26823# Bonn Univ. (West Germany).
HIGH ENERGY PARTICLES IN COSMIC RAY SOURCES
M. Grewing 1971 24 p In GERMAN Presented at Autumn Conf. on High Energy Phys., Hamburg, 13 Sep. 1971
(Conf-710974-6) Avail: AEC Depository Libraries

The origin of high energy particles in the cosmic radiation from supernovae, radiogalaxies, quasars, and pulsars is discussed. NSA

N73-26824# Department of Supply, Melbourne (Australia). Antarctic Div.
COSMIC RAY RECORDS, CASEY, 1969 Anare Data Reports Publication No. 117
P. Johnstone and J. R. Bilson 1972 44 p refs
(NP-19680) Avail: AEC Depository Libraries HC $4.25

Tables for the following Antarctic data measurements are given: (1) Uncorrected neutron monitor data obtained at Wilkes, Jan to Apr 1969, and at Casey, Apr to Dec 1969; (2) neutron monitor data, corrected for barometric pressure variations, obtained at Wilkes, Jan to Apr 1969, and Casey, Apr to Dec 1969; and (3) mean hourly station level pressure in units of 0.1 mbar measured from a zero level of 940 mbar obtained at Wilkes, Jan to Apr, and Casey, Apr to Dec 1969. NSA

N73-26861* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GODDARD COSMIC X-RAY EXPERIMENT FOR OSO-1
E. A. Boldt *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 61-62 (For availability see N73-26855 17-30) CSCL 03A

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-26825 Texas Univ., Austin.
SPECTROSCOPIC STUDIES OF NOVA DELPHINI 1967 Ph.D. Thesis
Ashit Sanyal 1972 247 p
Avail: Univ. Microfilms Order No. 73-510

Spectroscopic observations of Nova Delphini 1967 were made during the period July 1967 to August 1969 with the coude' spectrographs of the 107 inch and 82 inch telescopes. The spectral range covered was gamma gamma 4000 to 9000 A, with special emphasis on the region gamma gamma 6000 to 9000 A in the nebular stage. The development of the spectrum through the nebular stage and its correlation with the light curve was discussed. The distance of the nova was estimated by three methods: (a) equivalent width of the Cal 2 K line, (b) rate of decline of the light curve and (c) interstellar reddening determined from helium and hydrogen line intensity ratios. Radial velocities of the various spectral features were determined and a spatial model for the nova in the nebular stage was proposed. Profiles of emission lines were found to have four major components, situated symmetrically to the zero velocity position and corresponding to emissions coming from the near and far sides of the nebulae respectively. Dissert. Abstr.

N73-26826 Texas Univ., Austin.
AN OBSERVATIONAL TEST OF ABSORPTION LINE FORMATION MODELS IN THE JOVIAN ATOMOSPHERE Ph.D. Thesis
Jay Thor Bergstralb 1972 263 p
Avail: Univ. Microfilms Order No. 73-404

The methane nu sub 3 band R-branch was observed in the spectrum of Jupiter, at seven points along the planet's equator, and the equivalent widths of four lines R(0), R(2), R(3) and R(5) were measured. Three models for spectral line formation in the Jovian atmosphere were tested by comparing variations in the equivalent widths of the methane lines, predicted by the models, with the observed variations. The reflecting-layer model, transparent gas above a diffuselyreflecting opaque surface, was used by almost all investigators to date to analyze quantitatively the Jovian spactrum. It can be made to reproduce the observed behavior of the methane absorption lines across the Jovian disk only is some rather artificial assumptions are made concerning the geometry of the reflecting surface, i.e. the Jovian cloud-tops. Dissert. Abstr.

N73-26827 Texas Univ., Austin.
OBSERVATIONS AND MODELS OF POLARIZATION IN LATE-TYPE STARS Ph.D. Thesis
Stephen Jacobs Shawl 1972 233 p
Avail: Univ. Microfilms Order No. 73-517

The nature of the particles that produce linearly polarized light from late type giant and supergiant stars is studied with polarimetric, photometric, spectroscopic and theoretical techniques. Observations, obtained at the Lunar and Planetary Laboratory, Kitt Peak, and McDonald Observatories from 1969 to the present time, are presented for 28 stars, with detailed discussions for o Cet, V CVn, X Her, g Her, VY CMa L2 Pup, IRC + 10216 and R Hva. For o Cet and V CVn a correlation is found between a marked increase in the polarization and the onset of hydrogen emission. This correlation is interpreted in terms of the formation of small particles in the stellar photosphere. Some stars show strong variations in the position angle with wavelength and time which can be interpreted in terms of the presence of two discrete particle sizes. There is an indication that the polarizing particles are closer to the star than are the particles that cause the infrared excess. Dissert. Abstr.

N73-26828 California Univ., Los Angeles.
MEAN MOTIONS INDUCED IN A LAYER OF FLUID BY TRAVELLING PERIODIC THERMAL SOURCES, WITH APPLICATION TO THE 4-DAY ZONAL CIRCULATION OF THE UPPER VENUS ATMOSPHERE Ph.D. Thesis
Richard Evans Young 1972 219 p
Avail: Univ. Microfilms Order No. 72-34005

Convective motions induced in a horizontal layer of fluid by traveling periodic thermal sources are investigated. All models considered are two-dimensional, bounded above and below by plane horizontal surfaces, and extending to infinity in the horizontal direction. The full nonlinear temperature and vorticity equations are numerically solved for simple Boussinesq models in the situation where the viscous diffusion time across the fluid layer is the same order as the period of the applied thermal forcing. The results indicate that large thermal forcing amplitudes are not in general sufficient to create mean velocities much greater than the phase speed of the thermal forcing. Linear theory expressions for the mean and fluctuating velocities are good

approximations significantly into the nonlinear regime.
Dissert. Abstr.

N73-26829 Stevens Inst. of Tech., Hoboken, N.J.
BULK VISCOSITY IN RELATIVISTIC HOMOGENEOUS ISOTROPIC COSMOLOGIES Ph.D. Thesis
John David Nightingale 1972 168 p
Avail: Univ. Microfilms Order No. 72-31172

Bulk viscosity is introduced into the stress-energy tensor of the cosmological fluid for Friedmann universes. Equations are obtained for the modification of the Robertson-Walker-metric scale-factor, the energy-density, and the Hubble-related age. An explicit form for the coefficient of bulk-viscosity is then found by means of the relativistic Boltzmann equation, solved by the Grad method of moments. It is found that, to a first approximation (using a Juttner-type distribution function) none of the three transport coefficients (bulk viscosity, shear viscosity and thermal conductivity) involve the Hubble constant. The high value of dimensionless entropy per baryon associated with the present background radiation of the universe can not therefore be accounted for on the basis of bulk-viscous mechanism.
Dissert. Abstr.

N73-26830 Wisconsin Univ., Madison.
OBSERVATIONS OF THE 10,830 A METASTABLE HELIUM LINE IN THE SPECTRUM OF ALPHA-ORIONIS Ph.D. Thesis
Tenny Dahlin Lode 1972 205 p
Avail: Univ. Microfilms Order No. 72-24892

High resolution spectroscopic measurements of alpha-orionis, taken with the 84-inch telescope and a PEPSIOS spectrometer, were analyzed for evidence of lines due to metastable helium in the atmosphere of alpha-orionis and in the interstellar medium. The analysis indicates metastable helium in the atmosphere of alpha-orionis with a temperature of as high as 54,000 K moving radially inward with a velocity of 45 km/sec. This inward velocity, although unusual, is consistent with the earlier measurement. No interstellar helium lines were identified. The spectrum analysis indicated an upper limit of .02 A for the equivalent width of any interstellar lines. However, the most recent values for the metastable lifetime lead to predicted equivalent widths of well under .02 A. Hence, the absence of definite interstellar lines is not surprising. Scans of mu-cephei, vv-cephei and 119-tauri in the 10,830 A region which were taken at the same time are presented without detailed analysis. Dissert. Abstr.

N73-26831 Maryland Univ., College Park.
A STUDY OF 2-20 keV X-RAYS FROM THE CYGNUS REGION Ph.D. Thesis
Richard David Bleach 1972 133 p
Avail: Univ. Microfilms Order No. 72-28905

Two rocket-borne proportional counters each with 650 sq cm net area and 1.8 x 7.1 deg FWHM rectangular mechanical collimation surveyed the Cygnus region in the 2-20 keV energy range on two separate occasions. X-ray spectral data gathered on September 21, 1970 from discrete sources in Cygnus are presented. The data from Cyg X-1, Cyg X-2, and Cyg X-3 have sufficient statistical significance to clearly indicate mutually exclusive spectral forms for the three. Upper limits are presented for X-ray intensities above 2 keV for Cyg X-4 and Cyg X-5 (Cygnus Loop). A search was made on August 9, 1971 for a diffuse component of X-ray > 1.5 keV associated with an interarm region of the galaxy at galactic longitudes in the vicinity of 60 degrees. A statistically significant excess associated with a narrow disk component was detected. The angular extent of this component has a most probable value of 2 degrees and may be as large as 7 degrees at 90% confidence. Dissert. Abstr.

N73-26832 California Univ., Los Angeles.
THE MORPHOLOGY OF RICH CLUSTERS OF GALAXIES Ph.D. Thesis
Edwin Charles Krupp 1972 166 p
Avail: Univ. Microfilms Order No. 72-33944

The morphology was studied of forty-three relatively rich and nearby clusters of galaxies. Relative positions, approximate Hubble types, and apparent visual magnitudes are estimated for galaxies in the clusters after clearly defined cluster centers and angular radii are established. The data are analyzed for estimates of cluster richness, spiral galaxy content, degree of central condensation, degree of projected radial symmetry, and luminosity function peculiarities. Comparison of cluster characteristics demonstrates the wide variation in them from cluster to cluster and suggests a set of descriptive, generalized cluster forms.
Dissert. Abstr.

N73-26833 Texas Univ., Austin.
ROTATING STELLAR ATMOSPHERES: A MODEL FOR ALTAIR Ph.D. Thesis
Peter Rolf Jordahl 1972 232 p
Avail: Univ. Microfilms Order No. 73-464

One particular rapid rotator (altair) is studied in considerable detail, and a model is developed which represents as well as possible four different kinds of data: the projected equatorial rotational velocity, the interferometric angular diameter, the absolute monochromatic flux at 5556 A above the earth's atmosphere, and the absolute energy distribution. Altair is perhaps the only object for which the data are adequate for such a study, since it has both a large parallax and a well-determined angular diameter, and its projected equatorial rotational velocity (250 km/sec) is one of the largest known at its spectral type. The rotating models calculated assume uniform rotation, a Roche model for the potential, and von Zeipel's relation between local effective gravity and local flux to determine the variation of temperature and gravity across the surface of the model.
Dissert. Abstr.

N73-26834 Texas Univ., Austin.
NONLINEAR ESTIMATION THEORY APPLIED TO ORBIT DETERMINATION Ph.D. Thesis
Chul Young Choe 1972 202 p
Avail: Univ. Microfilms Order No. 73-417

The development of an approximate nonlinear filter using the Martingale theory and appropriate smoothing properties is discussed. The filter developed is of the same class as the modified Guassian second order filter and is evaluated in a simulated study of the problem of estimating the state of an interplanetary space vehicle during both a simulated Jupiter fly-by and a simulated Jupiter orbiter mission. Results obtained with the extended Kalman filter and the performance of each filter are determined by comparison with the actual estimation errors. The simulations are designed to determine the effects of the second order terms in the dynamic state relations, the observation-state relations, and in the Kalman gain compensation term. The result of an extensive simulation shows that the Kalman gain compensated filter which includes only the Kalman gain compensation term is superior to all of the other filters. Dissert. Abstr.

N73-26835# Porto Univ. (Portugal).
OCCULTATION OF STARS BY THE MOON
Jose Osorio and Nazareth Rego 1972 13 p
(Publ-28) Avail: NTIS HC $3.00

Results of stellar occultations observed in 1971 are presented in tabular form. Observations were made by the Astronomical Observatoyr, Prof. Manuel de Barros of the University of Porto.
E.H.W.

N73-26836# Porto Univ. (Portugal).
OCCULTATION OF STARS BY THE MOON
Jose Osorio 1971 26 p refs
(Publ-25) Avail: NTIS HC $3.50

The results of occultation observations during the period 1969 to 1970 are presented. Tabular astronomical coordinates are listed which detail the apparent velocity of the moon, the angle between the direction of motion of the moon and the direction of the occulted star, and the excess of the apparent distance of the star from the center of the moon reduced to the geocentric distance of the moon.
J.M.M.

N73-26837# Porto Univ. (Portugal). Astronomical Observatory.
PROFESSOR M. G. PEREIRA DE BARROS AND THE ASTRONOMICAL OBSERVATORY OF THE UNIVERSITY OF PORTO
Jose Osorio [1971] 19 p
Avail: NTIS HC $3.00

The work of Professor M. G. Pereira de Barros in the field

of astronomy is outlined. Specifically, data on instrumentation he designed and built, and his astronomical observatory of the University of Porto are described. Special emphasis was given to the design of a mirror transit instrument. E.H.W.

N73-26838*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DETERMINING PARTICLE DENSITY USING KNOWN MATERIAL HUGONIOT CURVES Patent Application
John D. DiBattista, inventor (to NASA) Filed 5 Jun. 1973 33 p
(NASA-Case-LAR-11059-1; US-Patent-Appl-SN-367294) Avail: NTIS HC $3.75 CSCL 03B

A method is described for determining the density of impacting particles such as meteoroids by using Hugoniot curves. A plate of known material of finite thickness is impacted with a particle of unknown material. The closing velocity between particle and plate is known. The impacting particle sends a shockwave into the plate. A device is included, which measures the time for the shockwave to propagate through the plate and the time between impact flash on the target's front surface and the time for the resultant shockwave to reach the plate's rear surface. These measurements furnish velocity data. By comparing this with points of intersection for Hugoniot curves of known particle materials and the plate, the density of the particle is determined. NASA

N73-26839*# Geological Survey, Washington, D.C.
THE CONTRIBUTIONS OF RANGER PHOTOGRAPHS TO UNDERSTANDING THE GEOLOGY OF THE MOON
N. J. Trask 1972 21 p refs Sponsored by NASA
(NASA-CR-133090; Paper-599-J; LC-72-600142) Avail: NTIS MF $.95; SOD HC $0.40 CSCL 03B

Vidicon photographs returned to earth by Rangers 7, 8, and 9 in 1964 and 1965 were used to study the details of lunar geologic units previously recognized from earth-based telescopic photographs and to make geologic maps at a variety of scales. The photographs from each mission changed continuously in scale as the spacecraft approached impact. The final frames had resolutions some 1,000 times better than the best earth-based photographs. Lunar stratigraphic units mapped at a scale of 1:1,000,000 displayed, at these larger scales, differences in properties and, possibly, in ages, but a clear-cut stratigraphic succession of subunits was not apparent. The plains-forming materials in both terra and mare were divisible into units mainly on the basis of the differences in the total number of superposed craters and in the relative number of craters of various morphologic types. Author

N73-26840*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE LAST BALMER LINE AND H GAMMA IN MODEL B STARS
David Fischel and Daniel A. Klinglesmith Nov. 1972 24 p refs Submitted for publication
(NASA-TM-X-66266; X-671-72-437) Avail: NTIS HC $3.25 CSCL 03B

Profiles of the last few Balmer lines (H12-H27) and the full profiles of the H gamma line were computed for a grid of hydrogen line blanketed model atmospheres. The use of the last hydrogen line and the equivalent width of H gamma provide a quick means of estimating the effective temperature and surface gravity of B stars. Regression curves relating the quantum number of the last hydrogen line to the electron density in the model atmosphere are given. Futhermore, it is shown that the difference in the gravity determination deduced from H gamma equivalent widths using the Edmonds-Schuter-Wells formalism and the Griem wing formulae is, at worst, 0.18 in the common logarithm. Author

N73-26841*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IRON ABUNDANCE IN THE MOON FROM MAGNETOMETER MEASUREMENTS
Curtis W. Parkin (Santa Clara Univ.), Palmer Dyal, and William D. Daily Apr. 1973 37 p refs Prepared in cooperation with Santa Clara Univ.
(NASA-TM-X-62279) Avail: NTIS HC $4.00 CSCL 03B

Apollo 12 and 15 lunar surface magnetometer data with simultaneous lunar orbiting Explorer 35 data are used to plot hysteresis curves for the whole moon. From these curves a whole-moon permeability mu = 1.029 + 0.024 or - 0.019 is calculated. This result implies that the moon is not composed entirely of paramagnetic material, but that ferromagnetic material such as free iron exists in sufficient amounts to dominate the bulk lunar susceptibility. From the magnetic data the ferromagnetic free iron abundance is calculated. Then for assumed compositional models of the moon the additional paramagnetic iron is determined, yielding total lunar iron content. The calculated abundances are as follows: ferromagnetic free iron = 5 + or - 4 wt. percent, and total iron in the moon = 9 + or - 4 wt. percent. Author

N73-26842*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SURFACE MAGNETOMETER EXPERIMENTS: INTERNAL LUNAR PROPERTIES
Palmer Dyal, Curtis W. Parkin (Santa Clara Univ.), and William D. Daily Apr. 1973 42 p refs Prepared in cooperation with Santa Clara Univ.
(NASA-TM-X-62278) Avail: NTIS HC $4.25 CSCL 03B

Magnetic fields have been measured on the lunar surface at the Apollo 12, 14, 15, and 16 landing sites. The remanent field values at these sites are respectively 38 gammas, 103 gammas (maximum), 3 gammas, and 327 gammas. Simultaneous magnetic field and solar plasma pressure measurements show that the remanent fields at the Apollo 12 and 16 sites are compressed and that the scale size of the Apollo 16 remanent field is 5 < or = L < 100 km. The global eddy current fields, induced by magnetic step transients in the solar wind, were analyzed to calculate an electrical conductivity profile. From nightside data it was found that deeper than 170 km into the moon, the conductivity rises from 0.0003 mhos/m to 0.01 mhos/m at 1000 km depth. Analysis of dayside transient data using a spherically symmetric two-layer model yields a homogeneous conducting core of radios 0.9 R and conductivity sigma = 0.001 mhos/m, surrounded by a nonconducting shell of thickness 0.1 R. This result is in agreement with a nonconducting profile determined from nightside data. The conductivity profile is used to calculate the temperature for an assumed lunar material of peridotite. In an outer layer the temperature rises to 850 to 1050 K, after which it gradually increases to 1200 to 1500 K at a depth of approximately 1000 km. Author

N73-26843*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A STUDY OF ZODIACAL LIGHT MODELS
G. A. Gary and P. D. Craven Washington Jun. 1973 302 p refs
(NASA-TN-D-7263; M-454) Avail: NTIS HC $6.00 CSCL 03B

A review is presented of the basic equations used in the analysis of photometric observations of zodiacal light. A survey of the methods used to model the zodiacal light in and out of the ecliptic is given. Results and comparison of various models are presented, as well as recent results by the authors. Author

N73-26844*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 PROJECT. VOLUME 3: MISSION OPERATIONS SYSTEM IMPLEMENTATION AND STANDARD MISSION FLIGHT OPERATIONS
1 Jul. 1973 143 p refs
(Contract NAS7-100)
(NASA-CR-133184; JPL-TR-32-1550-Vol-3) Avail: NTIS HC $9.25 CSCL 22A

The Mariner Mars 1971 mission which was another step in the continuing program of planetary exploration in search of evidence of exobiological activity, information on the origin and evolution of the solar system, and basic science data related to the study of planetary physics, geology, planetology, and cosmology is reported. The mission plan was designed for two spacecraft, each performing a separate but complementary mission. However, a single mission plan was actually used for Mariner 9 because of failure of the launch vehicle for the first spacecraft. The implementation is described, of the Mission Operations System, including organization, training, and data

processing development and operations, and Mariner 9 spacecraft cruise and orbital operations through completion of the standard mission from launch to solar occultation in April 1972 are discussed. Author

N73-26845*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE 1973 SPACE SHUTTLE TRAFFIC MODEL
Jul. 1973 180 p
(NASA-TM-X-64751) Avail: NTIS HC $11.00 CSCL 22A

Traffic model data for the space shuttle for calendar years 1980 through 1991 are presented along with some supporting and summary data. This model was developed from the 1973 NASA Payload Model and the NASA estimate of the 1973 Non-NASA/Non DoD Payload Model. The estimates for the DoD flights included in this document are based on the 1971 DoD Mission Model. Author

N73-26846*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE 1973 EXPENDABLE LAUNCH VEHICLE TRAFFIC MODEL
Jul. 1973 93 p
(NASA-TM-X-64752) Avail: NTIS HC $6.75 CSCL 22A

Traffic model data for current expendable launch vehicles (assuming no Space Shuttle) for calendar years 1980 through 1991 and presented along with some supporting and summary data. This model was based on a payload program equivalent in scientific return to the 1973 NASA Payload Model, the NASA estimated non NASA/non DoD Payload Model, and the 1971 DoD Mission Model. Author

N73-26847*# Kanner (Leo) Associates, Redwood City, Calif.
AGES, Rb-87 Sr-87 OF SOIL AND ROCK FRAGMENTS BROUGHT FROM THE LUNAR MOUNTAINS BY LUNA 20
Jean-Louis Birck and Claude J. Allegre Washington NASA Jun. 1973 10 p refs Transl. into ENGLISH from Earth Planet. Sci. Lett. (Netherlands), v. 17, 1972 p 24-28
(Contract NASw-2481)
(NASA-TT-F-14981) Avail: NTIS HC $3.00 CSCL 03B

Results are reported on Rb-87 and Sr-87 found in fragments from the Luna 20 mission. The results show a low radiogenic character, but clearly demonstrate the presence of high K components. A model for lunar evolution is presented. Author

N73-26848*# Techtran Corp., Glen Burnie, Md.
THE GLOBAL TECTHONICS OF THE MOON AND THE EARTH
V. V. Kozlov, Yu. Ya. Kuznetsov, and Ye. D. Sulidi-Kondratyev Washington NASA Jun. 1973 19 p ref Transl. into ENGLISH from Priroda (Moscow), no. 10, Oct. 1972 p 21-28
(Contract NASw-2037)
(NASA-TT-F-14947) Avail: NTIS HC $3.00 CSCL 03B

Hypotheses concerning tectonic development, composition, and structural similarities of the earth and moon are presented. A comparative study indicates primary tectonic elements of both planets are similar in structure and were probably evolved in a similar manner. E.H.W.

N73-26849*# Scientific Translation Service, Santa Barbara, Calif.
INTERSTELLAR MOLECULES
J Guertler Washington NASA Jul. 1973 20 p Transl. into ENGLISH from Astron. Raumfahrt (West Ger.), no. 5, 1972 p 129-136
(Contract NASw-2483)
(NASA-TT-F-14961) Avail: NTIS HC $3.00 CSCL 03B

Discovery of interstellar molecules through visible, ultraviolet, and radio wave absorption and emission is covered historically. Molecular sources are could be formed and destroyed. Author

N73-26850*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 12 MISSION REPORT. SUPPLEMENT 4: ASCENT PROPULSION SYSTEM FINAL FLIGHT EVALUATION
W. G. Griffin Sep. 1972 63 p refs Prepared by TRW Systems Group
(Contract NAS9-8166)
(NASA-TM-X-69529; TRW-17618-H001-R0-00-Suppl-4; MSC-01855-Suppl-4) Avail: NTIS HC $5.25 CSCL 22C

The results of the postflight analysis of the ascent propulsion system (APS) performance during the Apollo 12 Mission are presented. The steady-state performance analysis, and pressurization system are discussed along with the propellant loading and usage, APS overburn, and burn time. It is concluded that APS flight performance reconstructions for LM-3, LM-4, LM-5, and LM-6 indicate that engine performance prediction techniques are conservative. F.O.S.

N73-26851*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 17 MISSION 5-DAY REPORT
Dec. 1972 46 p
(NASA-TM-X-69527; MSC-07666) Avail: NTIS HC $4.50 CSCL 22C

A five day report of the Apollo 17 mission is presented. The subjects discussed are: (1) sequence of events, (2) extravehicular activities, (3) first, second, and third lunar surface extravehicular activity, (4) transearth extravehicular activity, (5) lunar surface experiments conducted, (6) orbital science activities, (7) spacecraft reentry and recovery. Author

N73-26852*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 17 MISSION EVALUATION PLAN
Sep. 1972 78 p
(NASA-TM-X-69324; MSC-07361) Avail: NTIS HC $6.00 CSCL 22C

This plan contains information for the MSC Mission Evaluation Team in support of the Apollo 17 prelaunch checkout and the mission. Key personnel are identified and their responsibilities are defined. The interfaces of the Mission Evaluation Team with the launch center during prelaunch testing, and with the Spacecraft Analysis and Flight Control Teams during the mission, are also explained. The plan is written in two parts. The first part defines the Mission Evaluation Team support to the Launch Center commencing with the subsystem checkout performed on the pad (Test and Checkout Procedures K-0005 for the CSM and KL-0045 for the lunar module). The second part defines the continuous support provided during the mission to the Spacecraft Analysis Room and, subsequently, to the Mission Operations Control Room at MSC. The second part will be updated about 30 days prior to the mission to reflect personnel and measurement changes. Author

N73-26853*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 17 MISSION EVALUATION PLAN
Nov. 1972 79 p Revised
(NASA-TM-X-69530; MSC-07361-Rev-A) Avail: NTIS HC $5.75 CSCL 22C

For abstract, see N73-26852

N73-26854*# California Inst. of Tech., Pasadena. Seismological Lab.
THE MOON AS A HIGH TEMPERATURE CONDENSATE
Don L. Anderson 16 Aug. 1972 53 p refs Presented at IAU Symp. on Cosmochem., Cambridge, Mass., 14-16 Aug. 1972
(NASA-CR-132209; Contrib-2260) Avail: NTIS HC $4.75 CSCL 03B

The accretion during condensation mechanism is used to explain the differences in composition of the terrestrial planets and the moon. Many of the properties of the moon, including the enrichment in Ca, Al, Ti, U, Th, Ba, Sr and the REE and the depletion in Fe, Rb, K, Na and other volatiles can be understood if the moon represents a high temperature condensate from the solar nebula. Thermodynamic calculations show that Ca, Al and Ti rich compounds condense first in a cooling nebula. The high temperature mineralogy is gehlenite, spinel perovskite, Ca-Al-rich pyroxenes and anorthite. The model is consistent with extensive early melting, shallow melting at 3 A.E. and with presently high speed internal temperatures. It is predicted that the outer 250 km is rich in plagioclase and FeO. The low iron content of the interior in this model raises the interior temperatures estimated from electrical conductivity by some 800 C. The lunar crust is

80 percent gabbroic anorthosite, 20 percent basalt and is about 250-270 km thick. The lunar mantle is probably composed of spinel, merwinite and diopside with a density of 3.4 g/cu cm.
Author

N73-26855# European Space Research Organization, Paris (France).
X-RAY ASTRONOMY IN THE NEAR FUTURE
Feb. 1973 193 p refs Colloq. held at Frascati, Italy, May 1972
(ESRO-SP-87) Avail: NTIS HC $11.75

Results and findings of experiments performed in the Uhuru program are presented. Current developments in X-ray astronomy are described along with X-ray experiments onboard OAO-C, UK-5, SAS-C, OSO-1, Corsa Japanese satellite, HEAO-A, HEAO-B, HEAO-C, and Helos spacecraft. For individual titles, see N73-26856 through N73-26874.

N73-26856 American Science and Engineering, Inc., Cambridge, Mass.
SURVEY OF CURRENT OF CURRENT DEVELOPMENTS IN X-RAY ASTRONOMY
Riccardo Giacconi *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 1-18 (For availability see N73-26855 17-30)

Current developments in X-ray astronomy are surveyed. The X-ray sky as it is presently known after the Uhuru X-ray observatory launching during 1970 is reviewed. A class of galactic sources such as supernovae, Sco X-1, pulsating stars in binary systems are described to illustrate the progress from discovery to detailed study of physical parameters in the objects. Also discussed is the recent observation of X-ray emission from great clusters of galaxies to illustrate how greatly the scope of X-ray astronomy has expanded and how it may futher be expanded to give information about objects at cosmological distances. ESRO

N73-26857 University Coll., London (England). Mullard Space Science Lab.
THE OAO-C X-RAY EXPERIMENT **c14**
P. W. Sanford *In* ESRO X-ray Astronomy in the Near Future Feb. 1973 p 19-23 (For availability see N73-26855 17-30)

The OAO-C X-ray experimental design is described. The experiment includes five telescope systems, an optical star tracker, and three X-ray mirrors covering the range from 3 to 9 A, 6 to 18 A, and 20 to 100 A. Small volume proportional counters are used for the 3 to 9 A and 6 to 18 A telescopes. Estimated performance of the equipment shows that the weakest sources in the Uhuru catalog can be detected in about one orbit. Proposals for observations to be made with the instrument are listed.
ESRO

N73-26858 University Coll., London (England). Mullard Space Science Lab.
THE UK-5 X-RAY EXPERIMENTS **c31**
P. W. Sanford *In* ESRO X-ray Astronomy in the Near Future Feb. 1973 p 25-29 (For availability see N73-26855 17-30)

The main UK-5 spacecraft parameters are given and experiment parameters reviewed. Two instruments are detailed and the performance of all experiments is shown. ESRO

N73-26859 Massachusetts Inst. of Tech., Cambridge.
DESCRIPTION AND PERFORMANCE OF THE THIRD SMALL ASTRONOMY SATELLITE (SAS-C) **c14**
William Mayer *In* ESRO X-ray Astronomy in the Near Future Feb. 1973 p 31-50 (For availability see N73-26855 17-30)

The SAS-C objectives are presented. Systems relating to the HELOS experiment, as the systems to determine the location of extragalactic and galactic X-ray sources to 10 sec of arc, and to measure the low energy X-ray emission from selected objects in the energy ranges from 35 to 28 A and 60 to 44 are discussed. The various operational modes of both the experiment and the spacecraft are given. Physical parameters and performance of the primary system consisting of Star cameras and modulation collimators for determining the precise position of X-ray sources are discussed, as well as the low energy systems on SAS-C consisting of a sealed porportional counter with a titanium window, and parabolic concentrators, a filter wheel, proportional counter with polypropylene window, and a gas supply system. ESRO

N73-26860 Utrecht State Univ. (Netherlands). Astronomical Inst.
X-RAY EXPERIMENT IN THE ASTRONOMICAL NETHERLANDS SATELLITE (ANS) **c14**
John Heise *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 51-59 (For availability see N73-26855 17-30)

The technical description and scientific aims of the soft X-ray and hard X-ray experiments of the Astronomical Netherlands Satellite payload are presented. ESRO

N73-26861* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GODDARD COSMIC X-RAY EXPERIMENT FOR OSO-1 **c29**
E. A. Boldt *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 61-62 (For availability see N73-26855 17-30)
CSCL 03A

The primary objective of this experiment is to utilize proportional counters of multi-anode multi-layer construction to obtain the spectra of X-ray sources and the diffuse background over the 2 to 60 keV band. Possible broad emission lines, absorption, and spectral breaks in both discrete sources and the diffuse background will be investigated. A schematic representation of this experiment as configured for the OSO-1 wheel and characteristic parameters are summarized. ESRO

N73-26862* Columbia Univ., New York. Columbia Astrophysics Lab.
STELLAR X-RAY POLARIMETRY ON OSO-1 **c14**
P. B. Landecker and R. Novick *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 63-75 refs (For availability see N73-26855 17-30)
(Contract NAS5-11362; Grants NGR-33-008-102; NGR-33-008-125)
CSCL 03A

The importance of stellar X-ray polarimetry is reviewed. A graphite crystal polarimeter sensitive near 2.6 and 5.2 keV which was designed for the OSO-1 satellite is described. The instrument's predicted performance for many stellar X-ray sources is presented, and the fundamental questions that can be resolved with the OSO-1 polarimeter are considered. The sensitivity of the instrument is such that, during an observation time of 24 hours, the polarization of the Crab nebula can be measured with an accuracy of 0.6 percent. Author (ESRO)

N73-26863* Columbia Univ., New York. Columbia Astrophysics Lab.
STELLAR BRAGG CRYSTAL X-RAY SPECTROMETRY ON OSO-1 **c14**
P. B. Landecker and R. Novick *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 77-93 refs (For availability see N73-26855 17-30)
(Contract NAS5-11362; Grants NGR-33-008-102; NGR-33-008-125)
CSCL 03A

A high sensitivity crystal X-ray spectrometer for use on the Orbiting Solar Observatory (mission 1) satellite is described. This instrument will be used to obtain both solar and stellar spectra in the energy range 2 to 8 keV. In the stellar mode, the shape of the continua, the strength of lines, and the strength of recombination and absorption edge were determined. If lines or edges are detected, such data will provide direct evidence regarding the physical conditions in the emitting and absorbing regions. If only upper bounds are established, the data can be used to constrain theoretical models. In any case, precise continuum shapes will be established for a number of the brighter X-ray sources. Numerical estimates of the sensitivity of the instrument for these various purposes are given. Author (ESRO)

N73-26864 Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
CORSA JAPANESE SATELLITE **c31**
Minoru Oda *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 95-103 (For availability see N73-26855 17-30)

The Japanese space program is summarized with emphasis

on Corsa 1 flight model originally defined to achieve four scientific objectives, namely X-ray observation, gamma ray observation, measurement of alpha particles and of heavy primaries. Corsa 1 configurations and X-ray instrument data handling system are discussed. The Corsa 2, a Corsa 1 revised design, is described along with its principal objectives, namely observation of X-ray nova and very soft sources as well as heavy primaries. ESRO

N73-26865 University Coll., London (England). Mullard Space Science Lab.
THE COSMIC X-RAY EXPERIMENTS SELECTED FOR OSO-J c14
J. L. Culhane *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 105-110 (For availability see N73-26855 17-30)

Three low energy X-ray experiments were tentatively selected for the OSO-J mission for a possible launch in 1975. Two experiments were designed to study discrete sources and the diffuse components of soft X-radiation in the X-ray and X-UV energy range 0.01 keV to 2.0 keV with the aid of grazing incidence optics. A third instrument provides images of its fields of view with the aid of a Fresnel mask. Author (ESRO)

N73-26866 Naval Research Lab., Washington, D.C.
DESCRIPTION OF NRL HEAO-A EXPERIMENT c14
Seth D. Shulman *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 111-114 (For availability see N73-26855 17-30)

The HEAO-A experimental design is described. It consists of six mapping modules each including a proportional counter with 3000 sq cm of effective area and six phoswich detectors with a total of 450 sq cm effective area. Performance which can be achieved with this equipment is predicted. ESRO

N73-26867 Massachusetts Inst. of Tech., Cambridge.
INTEGRATED MODULATION COLLIMATOR EXPERIMENT ON HEAO-A FOR OBSERVATION OF X-RAY SOURCES IN THE ENERGY RANGE 1-15 keV c14
Gianfranco Spada *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 115-126 (For availability see N73-26855 17-30)

This experiment, aimed at determining the position and size of cosmic X-ray sources in the energy range 1 to 50 keV, is based on the use of a pair of scanning modulation collimators and four rotating modulation collimators. The performance of the instrument in flight, based on results obtained from the measurement of size and position of the Crab nebula during a rocket payload flight in 1966, is briefly discussed. ESRO

N73-26868 Leicester Univ. (England).
THE HELOS SCIENTIFIC MISSION AND ITS EXPERIMENTAL PACKAGE c31
K. A. Pounds *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 127-139 refs (For availability see N73-26855 17-30)

Using the method of lunar occultation, a study based on the use of Europa 2 type launcher and a medium size 200-250 kg) satellite in a highly eccentric orbit (200,000 km) showed that the occultation of about one fifth of the known X-ray sources can be observed, leading to accuracies in location down to one arc sec and even higher accuracy in the determination of angular dimensions of the strongest sources. The objectives of the HELOS mission are discussed. These are mainly centered on the location, identification, and analysis of the nature of X-ray galactic and extragalactic sources. The experiment package and its performance on positional accuracy, upper limit on angular size, minimum measurable size for the 2 to 20 keV and low energy experimental packages are described. ESRO

N73-26869 European Space Research and Technology Center, Noordwijk (Netherlands).
THE HELOS SPACECRAFT AND ORBITAL CONSIDERATIONS c31
R. Cosaert *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 141-154 (For availability see N73-26855 17-30)

Criteria for selecting the HELOS orbit are analyzed, as well as the occultation strategy and orbital maneuvers. The tracking, telemetry, and telecommand system is described, along with the attitude control and velocity impulse system. ESRO

N73-26870* Columbia Univ., New York. Columbia Astrophysics Lab.
BRAGG CRYSTAL SPECTROMETER FOR HEAO-B X-RAY ASTRONOMY EXPERIMENT c14
J. R. P. Angel and B. E. Woodgate *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 155-162 refs (For availability see N73-26855 17-30)
(Contract NAS8-27405; Grant NGR-33-008-102)
CSCL 14B

The X-ray astronomy experiment for the HEAO mission is described. The instrument to be flown on the satellite consists of two Bragg crystal spectrometers designed to make measurements with high spectral resolution in the energy range from 0.1 to 10 keV. No sharp spectroscopic features were detected directly in X-ray astronomy except emission lines in the sun; therefore, the objectives and design criteria of this instrument are based on the theoretical models of the different types of extra solar X-ray sources. From the point of view of instrumental techniques it is convenient to divide these into point or stellar sources, whose radiation is parallel, and diffuse sources, and to consider the possible spectral features in each type. ESRO

N73-26871* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEAO-B X-RAY EXPERIMENTS. NON-DISPERSIVE SPECTROSCOPY c14
E. A. Boldt *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 163-169 (For availability see N73-26855 17-30)
CSCL 03B

The scientific objectives of HEAO-B are presented. They include four X-ray and gamma ray experiments in addition to two charged cosmic ray experiments. The first X-ray experiment is one using standard proportional counters, mechanically collimated, and covers the region from 0.2 to 60 keV. It is being designed for the purpose of detecting small changes in the surface brightness of the X-ray sky over a very broad spectral range. The second X-ray experiment involves Bragg crystal spectrometers for the range 0.5 to 10 keV. In the low energy gamma ray experiment, which also extends into the X-ray region, a cooled germanium (lithium drifted) gamma-ray spectrometer was used. ESRO

N73-26872 American Science and Engineering, Inc., Cambridge, Mass.
THE HEAO-C (LOXT) MISSION c14
Riccardo Giacconi *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 171-180 (For availability see N73-26855 17-30)

The use of focusing optics in X-ray astronomy is introduced with the emphasis on the study of galactic and extragalactic X-ray sources by means of X-ray focusing telescopes. The LOXT experiment payload is described. It includes: a high resolution telescope with an effective area of about 1000 cu cm at long wavelengths, a short wavelength cut off at about 4 keV, and a theoretical rms blur-circle radius of less than one arc sec for rays within five arc min of the optical axis; a high efficiency mirror with an effective area of about 2000 sq cm at long wavelengths, a short wavelength cut off at about 5 keV, and a theoretical rms blur-circle of less than 1/2 arc min for rays within 10 arc min of the optical axis. The image intensifier with video readout, the focal plane crystal spectrometer, and the imaging proportional counter associated with the telescope are described. ESRO

N73-26873 University Coll., London (England). Mullard Space Science Lab.
THE HEAO-C SOFT X-RAY TELESCOPE c14
P. W. Sanford *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 181-182 (For availability see N73-26855 17-30)

The soft X-ray telescope is described and its optimum performance limitations discussed. Solutions to these limitations are proposed. ESRO

N73-26874 European Space Research Organization, Paris (France).
GENERAL DISCUSSION c31
V. Manno *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 183-186 (For availability see N73-26855 17-30)

A general discussion devoted mainly to an appreciation of the HELOS mission as compared with other X-ray astronomy projects is presented. ESRO

N73-26875# Chicago Univ., Ill. Lab. for Astrophysics and Space Research.
DEFINITION STUDY OF X-RAY BACKGROUND EXPERIMENT ON HEAO-A Annual Report, 1 Feb. 1971 - 31 Jan. 1972
Richard L. Blake 31 Jan. 1972 33 p refs
(Contract N00014-67-A-0285-0016; NRL Proj. 00173)
(AD-760364; AR-1) Avail: NTIS CSCL 03/2

Work under this contract during the past year has been part of a definition study being conducted jointly by NRL, the University of Chicago, and Bendix Corp. for establishing the design criteria of a Diffuse X-ray Background experiment on the HEAO-A satellite. GRA

N73-26365* Translation Consultants, Ltd., Arlington, Va.
THE USE OF TWO SPACED RADARS TO MEASURE METEOR DRIFTS
K. A. Karimov and V. V. Sidorov *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 18-27 refs (For availability see N73-26363 17-13)
CSCL 03B

N73-26366* Translation Consultants, Ltd., Arlington, Va.
ONE DIMENSIONAL EXPANSION OF A METEOR TRAIL
N. A. Arkabayev *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 28-33 refs (For availability see N73-26363 17-13)
CSCL 03B

N73-26368* Translation Consultants, Ltd., Arlington, Va.
A RADAR VARIANT FOR A METEORIC WIND PATROL
K. A. Karimov, V. D. Kostromin, and V. Ya. Ogurtsov *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 41-49 refs (For availability see N73-26363 17-13)
CSCL 03B

N73-26369* Translation Consultants, Ltd., Arlington, Va.
SECTOR RADIO MEASUREMENTS OF METEOR TRAIL DRIFTS BY LOW FREQUENCY RADAR TRANSMISSIONS
K. A. Karimov and V. Ya. Ogurtsov *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 50-56 refs (For availability see N73-26363 17-13)
CSCL 03B

N73-26370* Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF DIFFUSION IN THE METEOR ZONE
A. Ryskulov *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 57-60 refs (For availability see N73-26363 17-13)
CSCL 03B

N73-26371* Translation Consultants, Ltd., Arlington, Va.
DETERMINATION OF THE PARAMETER s
V. D. Kostromin *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 61-75 refs (For availability see N73-26363 17-13)
CSCL 03B

N73-26374* Translation Consultants, Ltd., Arlington, Va.
A GRAPHICAL METHOD FOR ESTABLISHING THE ACTIVE CURVE OF A METEOR RADIANT POINT ON A GIVEN PATH
N. N. Kalinina *In its* Invest. of the Ionosphere and Meteors Jun. 1973 p 81-89 refs (For availability see N73-26363 17-13)
CSCL 03B

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N73-26876* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DOCKING STRUCTURE FOR SPACECRAFT Patent
Robert R. Belew, inventor (to NASA) Issued 5 Jun. 1973 7 p Filed 6 Jul. 1971 Supersedes N71-35082 (09 - 21, p 3520)
(NASA-Case-MFS-20863; US-Patent-3,737,117;
US-Patent-Appl-SN-159966; US-Patent-Class-244-1SD;
US-Patent-Class-244-137P) Avail: US Patent Office CSCL 22B

A docking structure for a pair of spacecraft is described comprising a conical receptacle on the docking end of a first spacecraft that receives a mating conical projection on the docking end of the second spacecraft. The conical receptacle of the first spacecraft constitutes an exterior portion of a sealed gas-tight compartment. Pressurization of the sealed compartment causes the conical receptacle to extend toward the incoming conical projection of the second spacecraft. When the mating conical portions are latched together, the docking energy is absorbed by the compressed gas in the sealed compartment. Rebound forces are countered by a plurality of actuator cylinders supporting the conical receptacle. Official Gazette of the U.S. Patent Office

N73-26877*# Grumman Aerospace Corp., Bethpage, N.Y. Aerodynamics Section.
AN ANALYTICAL PROCEDURE FOR EVALUATING SHUTTLE ABORT STAGING AERODYNAMIC CHARACTERISTICS Final Report
R. Meyer 31 May 1973 128 p
(Contract NAS9-12581)
(NASA-CR-128974; MSC-08085) Avail: NTIS HC $8.50 CSCL 22C

An engineering analysis and computer code (AERSEP) for predicting Space Shuttle Orbiter - HO Tank longitudinal aerodynamic characteristics during abort separation has been developed. Computed results are applicable at Mach numbers above 2 for angle-of-attack between plus or minus 10 degrees. No practical restrictions on orbiter-tank relative positioning are indicated for tank-under-orbiter configurations. Input data requirements and computer running times are minimal facilitating program use for parametric studies, test planning, and trajectory analysis. In a majority of cases AERSEP Orbiter-Tank interference predictions are as accurate as state-of-the-art estimates for interference-free or isolated-vehicle configurations. AERSEP isolated-orbiter predictions also show excellent correlation with data. Author

N73-26878*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE TRAFFIC MODEL DEVELOPED FROM 1971 MISSION MODEL
Mar. 1973 60 p
(NASA-TM-X-64731) Avail: NTIS HC $5.00 CSCL 22B

Traffic model data for the space shuttle using the 1971 NASA, DOD, and commercial mission models are presented along with descriptions and schedules for the NASA and commercial payloads used to develop the data. Author

N73-26879*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACECRAFT DOCKING AND ALIGNMENT SYSTEM Patent Application
Donald C. Cheatham and Richard Reid, inventors (to NASA) Filed 15 Jun. 1973 15 p
(NASA-Case-MSC-12559-1; US-Patent-Appl-SN-370582) Avail: NTIS HC $3.00 CSCL 22B

A docking alignment system for spacecraft docking which eliminates the problems associated with off-axis targets and sights and the requirements for specific viewing ports is described. The system is based on television cameras mounted on each

spacecraft to provide an optical display to the operator. The components of the system and the manner of operation are described. Engineering drawings of the system are provided.
NASA

N73-26880*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SUBSONIC AERODYNAMIC CHARACTERISTICS OF A 60 DEG SWEPT DELTA WING SPACE SHUTTLE ORBITER
Delma C. Freeman, Jr. Washington Jul. 1973 57 p refs
(NASA-TM-X-2762; L-8722) Avail: NTIS HC $3.00 CSCL 22B

An investigation was conducted in the Langley low-turbulence pressure tunnel to determine Reynolds number effects on the low-subsonic areodynamic characteristics and longitudinal control effectiveness of a North American Rockwell phase B delta-wing orbiter concept designated 134D. The model was tested over a range of Reynolds numbers, based on body length, from 5.25 million to 29.4 million, at Mach numbers less than 0.35, at angles of attack from approximately -2 to 28, and at angles of sideslip of 0 and -6. Author

N73-26881*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PREDICTION OF PRESSURE FLUCTUATION IN SOUNDING ROCKETS AND MANIFOLDED RECOVERY SYSTEMS
John F. Laudadio Jun. 1972 76 p refs
(NASA-TM-X-65991; X-742-72-229) Avail: NTIS HC $6.00 CSCL 19G

The determination of altitude by means of barometric sensors in sounding rocket applications is discussed. A method for predicting the performance of such sensing systems is needed. A method is developed for predicting the pressure-time response of a volume subjected to subsonic air flow through from one to four passages. The pressure calculation is based on one-dimensional gas flow with friction. A computed program has been developed which solves the differential equations using a self-starting predictor-corrector integration technique. The input data required are the pressure sensing system dimensions, pressure forcing function(s) at the inlet port(s), and a trajectory over the time of analysis (altitude-velocity-time), if the forcing function is trajectory dependent. The program then computes the pressure-temperature history of the gas in the manifold over the time interval specified. Author

N73-26882*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OVERALL FLUCTUATING PRESSURE LEVELS ON PROSPECTIVE SPACE SHUTTLE LAUNCH CONFIGURATIONS AT MACH NUMBERS FROM 0.8 TO 2.2
Jules B. Dods, Jr., Richard D. Hanly, and James H. Efting Apr. 1973 383 p ref
(NASA-TM-X-62280) Avail: NTIS HC $21.25 CSCL 22B

Overall fluctuating pressure levels of seven space shuttle launch configurations are presented. The model was a 4-percent-scale space shuttle vehicle, tested in both a 11- by 11-foot transonic wind tunnel and a 9- by 7-foot supersonic wind tunnel. Mach numbers varied from 0.8 to 2.2, and the angle of attack range was from -8 deg to 8 deg at angles of sideslip of -5 deg, and 5 deg. The model configurations included both series-burn and parallel-burn configurations, two canopy configurations, two positions of the orbiter nose relative to the HO tank nose and two HO tank nose-cone angles (15 deg and 20 deg). The fluctuating pressure levels are presented in three forms.
Author

N73-26883*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SHUTTLE CRYOGENIC SUPPLY SYSTEM. OPTIMIZATION STUDY. VOLUME 5 B-1: PROGRAMMERS MANUAL FOR MATH MODELS Final Report
30 Jun. 1973 452 p refs
(Contract NAS9-11330)
(NASA-CR-133955; LMSC-A991396-Vol-5-B1) Avail: NTIS HC $24.75 CSCL 22B

A computer program for rapid parametric evaluation of various types of cryogenics spacecraft systems is presented. The mathematical techniques of the program provide the capability for in-depth analysis combined with rapid problem solution for the production of a large quantity of soundly based trade-study data. The program requires a large data bank capable of providing characteristics performance data for a wide variety of component assemblies used in cryogenic systems. The program data requirements are divided into: (1) the semipermanent data tables and source data for performance characteristics and (2) the variable input data which contains input parameters which may be perturbated for parametric system studies. Author

N73-26884*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SHUTTLE CRYOGENICS SUPPLY SYSTEM. OPTIMIZATION STUDY. VOLUME 5 B-2, PART 1: APPENDIX PROGRAMMERS MANUAL FOR MATH MODEL Final Report
30 Jun. 1973 354 p refs
(Contract NAS9-11330)
(NASA-CR-133956; LMSC-A991396-Vol-5-B-2-Pt-1) Avail: NTIS HC $19.75 CSCL 22B

An appendix to the programmers manual for the mathematical model pertaining to the design of cryogenic supply systems for spacecraft is presented. The program listing was produced using the EXEC-8 LISTALL processor which lists a file in alphabetical order. Since the processor does not differentiate between subroutines, functions, and procedure definition processors, each subprogram has been relabeled to clearly identify the type of symbolic listing. Author

N73-26885*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SHUTTLE CRYOGENICS SUPPLY SYSTEM. OPTIMIZATION STUDY. VOLUME 5 B-4: PROGRAMMERS MANUAL FOR SPACE SHUTTLE ORBIT INJECTION ANALYSIS (SOPSA) Final Report
30 Jun. 1973 151 p refs
(Contract NAS9-11330)
(NASA-CR-133957; LMSC-A991396-Vol-5-B-4) Avail: NTIS HC $9.75 CSCL 22B

A computer program for space shuttle orbit injection propulsion system analysis (SOPSA) is described to show the operational characteristics and the computer system requirements. The program was developed as an analytical tool to aid in the preliminary design of propellant feed systems for the space shuttle orbiter main engines. The primary purpose of the program is to evaluate the propellant tank ullage pressure requirements imposed by the need to accelerate propellants rapidly during the engine start sequence. The SOPSA program will generate parametric feed system pressure histories and weight data for a range of nominal feedline sizes. Author

N73-26886*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SHUTTLE CRYOGENICS SUPPLY SYSTEM OPTIMIZATION STUDY. VOLUME 5, B-3, PART 2: APPENDIX TO PROGRAMMERS MANUAL FOR MATH MODEL Final Report
30 Jun. 1973 379 p refs
(Contract NAS9-11330)
(NASA-CR-133958; LMSC-A991396-Vol-5-B-3-Pt-2) Avail: NTIS HC $21.00 CSCL 22B

A computer programmer's manual for a digital computer which will permit rapid and accurate parametric analysis of current and advanced attitude control propulsion systems is presented. The concept is for a cold helium pressurized, subcritical cryogen fluid supplied, bipropellant gas-fed attitude control propulsion system. The cryogen fluids are stored as liquids under low pressure and temperature conditions. The mathematical model provides a generalized form for the procedural technique employed in setting up the analysis program. Author

N73-26887*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SHUTTLE CRYOGENIC SUPPLY SYSTEM OPTIMIZATION STUDY. VOLUME 6: APPENDIXES Final Report
30 Jun. 1973 282 p refs
(Contract NAS9-11330)
(NASA-CR-133959; LMSC-A991396-Vol-6) Avail: NTIS HC

$16.25 CSCL 22B

The optimization of the cryogenic supply system for space shuttles is discussed. The subjects considered are: (1) auxiliary power unit parametric data, (2) propellant acquisition, (3) thermal protection and thermodynamic properties, (4) instrumentation and controls, and (5) initial component redundancy evaluations. Diagrams of the systems are provided. Graphs of the performance capabilities are included. Author

N73-26888# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
EXPERIMENT OF Mu-4S-4
Jul. 1972 31 p
Avail: NTIS HC $3.75

The Mu-4S-4 is described as a solid propellant four-stage rocket for launching the Radio Exploration Satellite REXS, which was designed for studying the ionosphere and magnetosphere. The scientific experiments, instruments, telemetry, and command system for REXS are discussed along with the power supply, and antennas. F.O.S.

N73-26889*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
CELESCOPE CATALOG OF ULTRAVIOLET STELLAR OBSERVATIONS: 5068 OBJECTS MEASURED BY ORBITING ASTRONOMICAL OBSERVATORY (OAO-2)
Robert J. Davis, William A. Deutschman, and Katherine L. Haramundanis 3 May 1973 206 p refs Sponsored in part by NASA
(NASA-CR-133259; SAO-Special-Rept-350; SAO-208-145A) Avail: NTIS HC $12.50 CSCL 22C

During the 16 months that the Celescope Experiment operated, it took 8000 frames of data. This report describes the experiment, the data it gathered, the format of the magnetic tape containing the data, and a number of programs that were written to read and manipulate the tape. The tape version of the catalog contains Data on 5068 stars and is available from the National Space Sciences Data Center. Author

N73-26890*# National Aeronautics and Space Administration, Washington, D.C.
SPACECRAFT THERMAL CONTROL Space Vehicle Design Criteria
May 1973 48 p refs
(NASA-SP-8105) Avail: NTIS HC $3.00 CSCL 22B

Guidance for the assessment and control of spacecraft temperatures is provided with emphasis on unmanned spacecraft in the space environment. The heat balance, elements of thermal design, and thermal control are discussed along with thermal testing, design criteria, and recommended practices. F.O.S.

N73-26891*# National Aeronautics and Space Administration, Washington, D.C.
SPACE VEHICLE ACCELEROMETER APPLICATIONS NASA Space Vehicle Design Criteria (Guidance and Control)
Dec. 1972 87 p refs
(NASA-SP-8102) Avail: NTIS HC $3.00 CSCL 22B

The physics of accelerometer applications are reviewed, and details are given on accelerometer instruments and the principles of their operations. The functions to which accelerometers are applied are listed, and terms commonly used in accelerometer reports are defined. Criteria guides state what rule, limitation, or standard must be imposed on each essential design element to insure successful design. Elaboration of these criteria in the form of recommended practices show how to satisfy each of these criteria, with the best procedure described when possible. Author

N73-26892*# Atomics International, Canoga Park, Calif.
DESIGN AND ANALYSIS OF THE RADIATOR STRUCTURE FOR SPACE POWER SYSTEMS
W. H. Dauterman and L. D. Montgomery 22 Jun. 1973 211 p refs
(NASA Order C-21030-C; Contract AT(04-3)-701)
(NASA-CR-121222; AI-AEC-13093) Avail: NTIS HC $12.75 CSCL 22B

The design, analysis, fabrication, and development of the 5-kWe radiator structure are shown. Thermal performance, meteoroid protection, structural capability during launch, development testing and space operation, material evaluation, and the configuration selection are described. The fin-tube development program depends on the relative values of the thermal coefficients of expansion. The initial selection of aluminum fins and Type 316 stainless-steel tubes was based on previous experience; however, the large differential in their expansion rates showed that an alternate, more compatible, combination was needed. Copper, stainless-steel-clad copper, boron-impregnated aluminum, and an independent radiator with a titanium structure were all considered as alternate materials. The final selection was Lockalloy fins with Type 304 stainless-steel D tubes. Author

N73-26893*# National Aeronautics and Space Administration, Washington, D.C.
SKYLAB 2, FIRST MANNED MISSION: NEWS RELEASE
6 Jul. 1973 10 p
(NASA-TM-X-69197) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22C

Mission events for the Skylab 2 flight are reported. Launching, docking, parasol deployment, workshop activities, SAS development, EVA, film retrieval, and reentry are briefly described. Biographical data are included for the astronauts. F.O.S.

N73-26894*# Boeing Co., Seattle, Wash.
INTEGRATED MEDICAL AND BEHAVIORAL LABORATORY MEASUREMENT SYSTEM ENGINEERING ANALYSIS AND LABORATORY SPECIFICATION Final Report
Caswell Grave and Donald W. Margold 30 Jun. 1973 201 p (Contract NAS9-11756)
(NASA-CR-133961) Avail: NTIS HC $12.25 CSCL 22B

Site selection, program planning, cost and design studies for support of the IMBLMS program were investigated. Accomplishments are reported for the following areas: analysis of responses to site selection criteria, space-oriented biotechnology, life sciences payload definition, and program information transfer. F.O.S.

N73-26895*# Lockheed Missiles and Space Co., Palo Alto, Calif.
SHUTTLE CRYOGENIC SUPPLY SYSTEM OPTIMIZATION STUDY. VOLUME 4: CRYOGENIC COOLING IN ENVIRONMENTAL CONTROL SYSTEMS Final Report
30 Jun. 1973 225 p
(Contract NAS9-11330)
(NASA-CR-133952; LMSC-A991396-Vol-4) Avail: NTIS HC $3.25 CSCL 22B

An analysis of cryogenic fluid cooling in the environmental control system of the space shuttle was conducted. The technique for treating the cryogenic fluid storage and supply tanks and subsystems as integrated systems was developed. It was concluded that a basic incompatibility exists between the heat generated and the cryogen usage rate and cryogens cannot be used to absorb the generated heat. The use of radiators and accumulators to provide additional cooling capability is recommended. Author

N73-26896*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 11 MISSION: GLYCOL TEMPERATURE CONTROL VALVE Anomaly Report No. 2
Oct. 1970 9 p
(NASA-TM-X-69200; MSC-03460) Avail: NTIS HC $3.00 CSCL 22B

An analysis was made of the cause or causes of malfunctions in the glycol temperature control valve during the Apollo 11 mission. The valve was designed to control inlet temperatures at 45 (+ or - 3) F. Test results show malfunctions were caused by a bearing failure on the worm gear shaft in the actuator. It was concluded that no corrective action was needed because an existing procedure allows manual setting of the value at a position which will meet system requirements. E.H.W.

N73-26897*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO 16 MISSION: OXIDIZER DESERVICING TANK FAILURE Anomaly Report No. 1

Nov. 1972 37 p ref
(NASA-TM-X-69323; MSC-07032-Rev-A) Avail: NTIS HC $4.00 CSCL 22C

An explosive failure of a ground support equipment decontamination unit tank occurred during the postflight deactivation of the oxidizer (nitrogen tetroxide) portion of the Apollo 16 command module reaction control system. A discussion of the significant aspects of the incident and conclusions are included. Author

N73-26898*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INERTIAL SUBSYSTEM WARNINGS AND COUPLING DATA UNIT FAILURE INDICATORS: APOLLO 16 MISSION Anomaly Report No. 3
Nov. 1972 8 p
(NASA-TM-X-69199; MSC-07571) Avail: NTIS HC$3.00 CSCL 22B

The indicated failures of the inertial coupling unit were investigated. The coupling data unit assembly failure detection circuits and the diagnostic tests are described. It is concluded that conductive contamination in a zener diode in the failure-detect circuit of the coupling data unit assembly most likely caused the problem. F.O.S.

N73-26899*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
UNEVEN DRIVE RATES OF THE SCANNING TELESCOPE: APOLLO 16 MISSION Anomaly Report No. 4
Nov. 1972 9 p
(NASA-TM-X-69233; MSC-07573) Avail: NTIS HC$3.00 CSCL 22B

An investigation was made into the cause or causes of uneven drive rates during operation of the Apollo 16 scanning telescope. It was suggested that such erratic behavior was caused by either changes in the characteristic noise level of the optics counter on the panels or the repositioning process by the computer or zero optics mode. Test results show the anomaly was not caused by either of the above suggestions, instead they were caused by a broken socket spring in the telescope harness. New harnesses will be manufactured for future flights. E.H.W.

N73-26900*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
WATER/GLYCOL TEMPERATURE CONTROL CIRCUIT FAILED IN THE AUTOMATIC MODE: APOLLO 16 Anomaly Report No. 2
Nov. 1972 11 p ref
(NASA-TM-X-69234; MSC-07598) Avail: NTIS HC$3.00 CSCL 22B

An anomaly report concerning failure of the water/glycol temperature control circuit during the Apollo 16 flight is presented. The anomaly is described and diagrams of the system are presented. The malfunction was caused by cracked semiconductor chips in the output silicon-controlled rectifier. Surface contamination in the crack allowed the device to self-gate on and remain on, resulting in a secondary failure of the feedback capacitor. Author

N73-26901# Oak Ridge National Lab., Tenn.
SHIELDING OF MANNED SPACE VEHICLES AGAINST GALACTIC COSMIC-RAY PROTONS AND ALPHA PARTICLES
R. T. Santoro, R. G. Alsmiller, Jr., and K. C. Chandler Mar. 1973 23 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4029) Avail: NTIS

Calculated results are presented of the absorbed-dose rates and dose-equivalent rates as a function of depth in tissue when galactic cosmic-ray proton and alpha-particle spectra are isotropically incident on a spherical shell shield with a tissue sphere at its center. Aluminum shield thicknesses of 5 and 20 g/sq cm are considered. It is found that the dose rates from incident alpha particles are comparable to those from incident protons, and for both protons and alpha particles there is a very appreciable contribution to the dose rates from nuclear-reaction products. Author (NSA)

N73-26902# British Aircraft Corp., Filton (England). Guided Weapons Technical Publications Dept.
SORTIE LABORATORY PRELIMINARY DEFINITION STUDY. REQUIREMENTS AND CONCEPTS REPORT. VOLUME 1: REQUIREMENTS
Nov. 1972 145 p Sponsored by ESRO 3 Vol.
(ESS/SS-399-Vol-1; ESRO-CR(P)-241) Avail: NTIS HC $9.25

The analysis used to establish the primary requirements of the experiment payloads to be carried on the Sortie Lab is presented. The basis of the payload analysis is noted. The shuttle interface is described, and the operational analysis covering experiment integration, in-flight and post-flight procedures is discussed. The project and design guidelines given by ESRO are included. ESRO

N73-26903# British Aircraft Corp., Filton (England). Guided Weapons Technical Publications Dept.
SORTIE LABORATORY PRELIMINARY DEFINITION STUDY. REQUIREMENTS AND CONCEPTS REPORT. VOLUME 2: CONCEPTS
Nov. 1972 316 p Sponsored by ESRO 3 Vol.
(ESS/SS-399-Vol-2; ESRO-CR(P)-242) Avail: NTIS HC $18.00

The assessments of requirements, the trade-off studies and the comparisons made to arrive at the preferred concept for each subsystem of the Sortie Lab are presented in detail. The possible system configurations are discussed primarily in relation to the experiment payload requirements while the basic accomodation capabilities of a limited range of these configurations is compared. The cost effectiveness of the configurations is assessed on a relative basis and related to the flexibility in meeting accommodation requirements. A preferred configuration is presented. ESRO

N73-26904# British Aircraft Corp., Filton (England). Guided Weapons Technical Publications Dept.
SORTIE LABORATORY PRELIMINARY DEFINITION STUDY. REQUIREMENTS AND CONCEPTS REPORT. VOLUME 3: SYSTEM EVALUATION
Nov. 1972 38 p refs Sponsored by ESRO 3 Vol.
(ESS/SS-399-Vol-3; ESRO-CR(P)-243) Avail: NTIS HC $4.00

An assessment is made of the chosen system and subsystem concepts of the Sortie Lab in relation to the overall requirements. In particular, the flexibility of the system concept is assessed relative to its ability to meet the requirements of the range of payload considered. The technological implications of the proposed concepts are considered in the light of European capabilities and a preliminary assessment of system costs is made. Preliminary assessments are also made of the operational use of the Sortie Lab with its payload together with the safety aspects involved. Potential growth of the system is discussed increasing to 6 crew and 30 day missions. A summary is presented of the work undertaken during the study on the two European infrared astronomy experiments and their accommodation and other experiments in the Sortie Lab payload. ESRO

N73-26905# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN DURING THE PERIOD FROM 11 MARCH TO 29 MARCH 1966
K. S. Russell 29 Mar. 1973 40 p ref
(ROE-STS-149) Avail: NTIS HC $4.00

Timed observations of satellites, made in azimuth and elevation with a kinetheodolite at Earlyburn Outstation, are listed in launch and time order for each satellite. Author (ESRO)

N73-26906# European Space Research and Technology Center, Noordwijk (Netherlands).
PIONEER-VENUS ORBITER PROJECT. ASSESSMENT REPORT OF FEASIBILITY STUDIES BY MBB, BAC, CIA
M. Schuyer, comp. 14 Feb. 1973 59 p refs
(SYST/2109/MS/1V) Avail: NTIS HC $5.00

The final assessment report of the feasibility study of the Venus orbiter to be jointly conducted by NASA and ESRO is presented. The background, industrial story, and further work is summarized, as well as conclusions and recommendations. The evaluation considers the payload, design, communication links, and despin antenna among other aspects. ESRO

N73-26907# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Div.
GIMBAL SYSTEM DESIGN STUDY FOR A DOUBLE GIMBALLED MOMENTUM WHEEL. PART 1: MISSION ANALYSIS Final Report
Aug. 1972 71 p refs Sponsored by ESRO Prepared for TELDIX
(ESRO-CR(P)-135) Avail: NTIS HC $5.75

The design requirements for a double gimballed flywheel are defined, and recommendations are made concerning the hardware design. The mission aspects are discussed followed by a dynamic analysis covering station keeping, gimbal angles, attitude control, and simulation. Equations of motion are also given. ESRO

N73-26908# Defence Research Establishment Valcartier (Quebec).
STRUCTURE OF TURBULENT WAKES OF HYPERSONIC SPHERES AS INFERRED WITH ION PROBES
D. Heckman and L. Sevigny Aug. 1972 62 p refs
(Contract DAHC01-69-C-0921; ARPA Order 133)
(AD-759157; DREV-R-669/72) Avail: NTIS CSCL 16/3

Survey arrays of ion probes have been used to study the structure of the ionized turbulent wakes of 2.7 inch diameter spheres flown at 14,500 feet/second in atmospheres of nitrogen at pressures of 7.6 and 20 torr. For various radial distances measured from wake axis, matrices of data points have been obtained giving random values of the axial distance behind the projectile at which ionization begins, the first ionized eddy occurs, and continuous turbulence begins. A wake radius separating the significantly ionized wake from the unionized wake has been obtained, and found to lie intermediate between the inviscid wake radius defined by Wilson from schlieren measurements and an electron density radius corresponding to the 1/e points of the electron density distribution defined by microwave interferometric measurements. A radius defining the extent of the ionized portion of the turbulent core has been determined; This radius is of the order of 80% of the schlieren radius of the turbulence core. (Author Modified Abstract) GRA

N73-26909# Defence Research Establishment Valcartier (Quebec).
ION DENSITY MEASUREMENTS IN THE WAKE OF A HYPERSONIC SPHERE
L. Sevigny, D. Heckman, and P. Caron Oct. 1972 92 p refs
(Contract DAHC01-69-C-0921; ARPA Order 133)
(AD-759158; DREV-R-670/72) Avail: NTIS CSCL 16/3

A report is presented of the results of a major research effort undertaken to determine experimentally, through the use of cylindrical electrostatic probes and existing probe theory, the levels of ion density in the turbulent wakes behind 2.7 inch diameter spheres flown at 14,500 feet/second in a ballistic range filled with nitrogen at 7.6 torr and at 20 torr. (Author Modified Abstract) GRA

N73-26858 University Coll., London (England). Mullard Space Science Lab.
THE UK-5 X-RAY EXPERIMENTS
P. W. Sanford *In* ESRO X-ray Astronomy in the Near Future Feb. 1973 p 25-29 (For availability see N73-26855 17-30)

N73-26864 Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
CORSA JAPANESE SATELLITE
Minoru Oda *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 95-103 (For availability see N73-26855 17-30)

N73-26868 Leicester Univ. (England).
THE HELOS SCIENTIFIC MISSION AND ITS EXPERIMENTAL PACKAGE
K. A. Pounds *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 127-139 refs (For availability see N73-26855 17-30)

N73-26869 European Space Research and Technology Center, Noordwijk (Netherlands).
THE HELOS SPACECRAFT AND ORBITAL CONSIDERATIONS
R. Cosaert *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 141-154 (For availability see N73-26855 17-30)

N73-26874 European Space Research Organization, Paris (France).
GENERAL DISCUSSION
V. Manno *In* ESRO X-Ray Astronomy in the Near Future Feb. 1973 p 183-186 (For availability see N73-26855 17-30)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-26910* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELECTRONIC STRAIN-LEVEL COUNTER Patent
Felix L. Pitts and John L. Spencer, inventors (to NASA) Issued 15 May 1973 6 p Filed 8 Jul. 1971 Supersedes N72-11803 (10 - 02, p 0257)
(NASA-Case-LAR-10756-1; US-Patent-3,733,424;
US-Patent-Appl-SN-160859; US-Patent-Class-73-88.5R;
US-Patent-Class-73-67.3; US-Patent-Class-73-91;
US-Patent-Class-235-92MT) Avail: US Patent Office CSCL 20K

An electronic strain level counter for obtaining structural strain data on in-flight aircraft is described. The device counts the number of times the strain at a point on an aircraft structural member exceeds each of several preset levels. A dead band is provided at each level to prohibit the counting of small strain variations around a given preset level.
Official Gazette of the U.S. Patent Office

N73-26911*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF THE DYNAMICS OF THIN PRIMARY MIRRORS FOR LARGE ASTRONOMICAL TELESCOPES
Aaron J. Ostroff and Mary McCann Washington Jul. 1973 64 p refs
(NASA-TM-X-2790; L-8893) Avail: NTIS HC $3.00 CSCL 14B

The NASTRAN structural analysis program was used to investigate the dynamic properties of thin primary mirrors suitable for use in large orbiting astronomical telescopes. An analysis is included of the mode shapes and modal frequencies for several thin, homogeneous, isotropic mirrors. Typical cases include two different mirror diameters, two different diameter-to-thickness ratios, and both a mirror without and a mirror with a central hole that is 22 percent of the mirror diameter. The finite-element structural model is evaluated by comparing the NASTRAN generated results with theoretical values for a simply supported, flat, circular mirror. The same model is then used for evaluating the spherical mirrors. The mode shapes and frequencies of a 0.762-meter-diameter mirror with a 60-to-1 diameter-to-thickness ratio and a three-point rigid kinematic (not overconstrained) mount are calculated and plotted for comparison with results obtained previously from the SAMIS structural analysis program for this same mirror. A static analysis is also shown for comparison with experimentally obtained influence coefficients. Author

N73-26912 Florida Univ., Gainesville.
STATIC AND DYNAMIC BUCKLING OF NONHOMOGENEOUS CYLINDRICAL SHEELS Ph.D. Thesis
C. W. Kim 1972 110 p
Avail: Univ. Microfilms Order No. 73-574

General equations of motion are derived for nonhomogeneous isotropic cylindrical shells by virtue of Hamilton's principle. The strain-displacement relations include large deflection effects and the contributions of circumferential displacement to changes of curvature and twist. The governing equations of motion for dynamic buckling problems are based upon the shallow shell theory. A numerical program which governs the dynamic buckling phenomenon of a cylindrical shell under lateral pressure

has been developed. The governing differential equations are replaced by finite-difference equations that are solved numerically. The explicit method is applied to the integration of time derivatives. Using the numerical program, several dynamic buckling problems are solved. A homogeneous cylindrical shell under a quasi-static impulse of step-pressure was first studied to compare with an analytical solution and several experimental works reported previously. The dynamic buckling of cylindrical shells with a different type of thickness has been investigated. Both linear and nonlinear cases are considered. Dissert. Abstr.

N73-26913 Princeton Univ., N.J.
ACTIVE CONTROL OF AN ELASTIC BODY Ph.D. Thesis
Charles F. Kalmbach, Jr. 1972 211 p
Avail: Univ. Microfilms Order No. 72-32750

A theoretical and experimental study is made to determine the feasibility of controlling a thin cantilevered beam subject to a (nonconservative) follower force. A theoretical model is developed using the equations for a thin beam under initial stress and Galerkin's method. An experiment is constructed with the capability of using a variety of feedback loops to control a thin aluminum beam with a tip jet mounted parallel to the chord. A particular control system is chosen for example and an increase of follower force required to destablize the beam of over 65% is recorded. The theoretical results show good correlation with the experimentally determined stability boundaries and frequency variations with follower force. The applicability of linear control theory, parameter optimization theory, and optimal feedback control theory is discussed. Linear control theory is used to explain the control of the beam. Dissert. Abstr.

N73-26914 Collins Radio Co., Cedar Rapids, Iowa.
EQUIVALENCE TECHNIQUES FOR VIBRATION TESTING
William C. Fackler Washington, D. C. Shock and Vibration Inform. Center. 1972 172 p refs
(Contract N00173-69-C-0325)
(AD-758414; SVM-9; LC-72-600168) Avail: Shock and Vibration Information Center, Naval Research Laboratory, Code 6020, Washington, D. C. 20390 HC $15.00/domestic, $18.75/foreign CSCL 14/2

The purpose of this monograph is to present a critical review of those equivalence techniques which have been and are used to define and simulate service vibration environments in the testing laboratory. A further objective of the monograph is to present a unified and current overview of the heretofore fragmented activities involved in the formulation of vibration equivalence methods. The term vibration equivalence shall be interpreted to be concerned with (1) the various techniques used to derive test levels; (2) The performance of tests intended to simulate the conditions of service vibration; and (3) the duplication of critical damage processes. The interpretation is extended to include those techniques which may be applied to derive substitute vibratory loads for use in product design and performance evaluation.
Author

N73-26915# Defence Standards Labs., Maribyrnong (Australia).
THE NATURAL FRAGMENTATION OF STEEL CYLINDERS WITH TEMPERED MARTENSITE MICROSTRUCTURES
A. J. Bedford Dec. 1972 42 p refs
(DSL-Rept-532) Avail: NTIS HC $4.25

Small steel cylinders with martensitic microstructures produced by heat treating steels of three different carbon contents were explosively fragmented. The relationships between the modes of fracture, the martensite compositions and heat treatment with particular reference to the fractography of adiabatically with sheared surfaces, were investigated. The possibility of correlating fragmentation behaviour with reduction of area at fracture, in a tensile test, and the need for further correlation of such results with both fragmentation and microstructural type are also given.
Author

N73-26916*# Prairie View Agricultural and Mechanical Coll., Tex. School of Engineering.
THE EFFECT OF YIELD STRENGTH AND DUCTILITY TO FATIGUE DAMAGE
H. Y. Yeh Feb. 1973 36 p refs
(Grant NGR-44-033-002)
(NASA-CR-133099; TR-CE-3) Avail: NTIS HC $4.00 CSCL 20K

The cumulative damage of aluminium alloys with different yield strength and various ductility due to seismic loads was studied. The responses of an idealized beam with a centered mass at one end and fixed at the other end to El Centro's and Taft's earthquakes are computed by assuming that the alloys are perfectly elastoplastic materials and by using numerical technique. Consequently, the corresponding residual plastic strain can be obtained from the stress-strain relationship. The revised Palmgren-Miner cumulative damage theorem is utilized to calculate the fatigue damage. The numerical results show that in certain cases, the high ductility materials are more resistant to seismic loads than the high yield strength materials. The results also show that if a structure collapse during the earthquake, the collapse always occurs in the very early stage.
Author

N73-26917*# Martin Marietta Corp., Orlando, Fla.
THESAURUS OF TERMS FOR INFORMATION ON MECHANICS OF STRUCTURAL FAILURE
Jr. Carpenter J. L. and Nestor Moya Jun. 1973 28 p
(Contract NAS3-16681)
(NASA-CR-121199; OR-12641) Avail: NTIS HC $3.50 CSCL 20K

A Thesaurus of approximately 700 subject terms used to describe the six problem areas in the mechanics of structural failure is presented. The initial criteria for the selection of terms are their significance and frequency of use in the literature describing the mechanics of structural failure. The purpose of the Thesaurus is to provide the Aerospace Safety Research and Data Institute a list of key works and identifiers that afford effective retrieval of information regarding failure modes and mechanisms for aerospace structures. The Thesaurus includes both a conventional listing of subject terms and a Key Words In Context (KWIC) listing.
Author

N73-26918*# Martin Marietta Corp., Orlando, Fla.
REGISTER OF EXPERTS FOR INFORMATION ON MECHANICS OF STRUCTURAL FAILURE
James L. Carpenter, Jr. and Nestor Moya Jun. 1973 82 p refs
(Contract NAS3-16681)
(NASA-CR-121200; OR-12642) Avail: NTIS HC $5.25 CSCL 20K

A list of approximately 150 experts from approximately 60 organizations who have published results of theoretical and/or experimental research related to six problem areas in the mechanics of structural failure is presented. Each author included is listed by organizational affiliation, address and principal field of expertise. The initial criteria for the selection of names for the register are recent contributions to the literature, participation in or support of relevant research programs, and referral by peers. The purpose of the register is to present, in easy reference form, sources for dependable information regarding failure modes and mechanisms of aerospace structures. The Register includes two indexes: an alphabetical listing of the experts and an alphabetical listing of the organizations with whom they are affiliated.
Author

N73-26919*# Martin Marietta Corp., Orlando, Fla.
REGISTER OF SPECIALIZED SOURCES FOR INFORMATION ON MECHANICS OF STRUCTURAL FAILURE
James L. Carpenter, Jr. and Frank J. Denny Jun. 1973 30 p
(Contract NAS3-16681)
(NASA-CR-121201; OR-12643) Avail: NTIS HC $3.50 CSCL 20K

Specialized information sources that generate information relative to six problem areas in aerospace mechanics of structural failure are identified. Selection for inclusion was based upon information obtained from the individual knowledge and professional contacts of Martin Marietta Aerospace staff members and the information uncovered by the staff of technical reviewers. Activities listed perform basic or applied research related to the mechanics of structural failure and publish the results of such research. The purpose of the register is to present, in easy reference form, original sources for dependable information regarding failure modes and mechanisms of aerospace structures. Author

N73-26920*# Martin Marietta Corp., Orlando, Fla.
BIBLIOGRAPHY OF INFORMATION ON MECHANICS OF STRUCTURAL FAILURE
James L. Carpenter, Jr., Nestor Moya, Richard A. Shaffer, and D. Michael Smith Jun. 1973 116 p refs
(Contract NAS3-16681)
(NASA-CR-121202; OR-12644) Avail: NTIS HC $8.00 CSCL 20K

A bibliography of approximately 1500 reference citations related to six problem areas in the mechanics of failure in aerospace structures is presented. The bibliography represents a search of the literature published in the ten year period 1962-1972 and is largely limited to documents published in the United States. Listings are subdivided into the six problem areas: (1) life prediction of structural materials; (2) fracture toughness data; (3) fracture mechanics analysis; (4) hydrogen embrittlement; (5) protective coatings; and (6) composite materials. An author index is included. Author

N73-26921# Royal Aircraft Establishment, Farnborough (England).
SOME BASIC CONSIDERATIONS ON CRACK ARRESTERS, PARTS 1-5
Takeshi Kanazawa, Susumu Machida, Masaaki Matoba, H. Tada, Isao Kimpara, Masao Yoshiki, and Masahiro Ohyagi Oct. 1972 112 p refs Transl. into ENGLISH from J. of the Soc. of Naval Architects of Japan, no. 115, 1964 p 78-88, no. 116, 1964 p 124-135, no. 118, 1965 p 192-203, no. 121, 1967 p 225-234, and no. 122, 1967 p 200-214
(RAE-Lib-Trans-1648; BR32286) Avail: NTIS HC $7.75

The principles of fracture mechanics are applied to the problem of preventing brittle fracture in sheet structures. Various methods of lowering the stress intensity factor, to arrest propagating cracks are studied. The effects of rivetted seams ahead of the line of crack propagation are considered. A theory is derived and numerical predictions are compared with experimental results. A theoretical study and an experimental investigation of the effect of a reinforcing patch welded or rivetted to the sheet ahead of the crack path are reported. The effect of integral stiffeners which are transverse to the crack path is analyzed. In general there were sufficient results to establish that the predictions of the various theoretical treatments are in agreement with experimental results. Author

N73-26922# Royal Aircraft Establishment, Farnborough (England).
FURTHER DEVELOPMENT OF AN EXPONENTIAL EQUATION FOR THE TENSION TESTING OF CONSTRUCTURAL ALLOYS
Cord W. Petersen Feb. 1973 10 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 58, no. 7, 1967 p 484-485
(RAE-Lib-Trans-1689; BR33565) Avail: NTIS HC $3.00

A new equation, which describes the power law strain hardening behavior during tension testing of engineering materials, is presented. The equation embodies one material property constant, that of the strain hardening exponent. Equations for calculating tensile and fracture stress are also given. Author

N73-26923*# Boeing Commercial Airplane Co., Seattle, Wash.
ELASTIC BUCKLING ANALYSIS FOR COMPOSITE STIFFENED PANELS AND OTHER STRUCTURES SUBJECTED TO BIAXIAL INPLANE LOADS
A. V. Viswanathan and M. Tamekuni Mar. 1973 89 p refs
(Contract NAS1-8858)
(NASA-CR-2216) Avail: NTIS HC $6.50 CSCL 20K

An exact linear analysis method is presented for predicting buckling of structures with arbitrary uniform cross section. The structure is idealized as an assemblage of laminated platestrip elements, curved and planar, and beam elements. Element edges normal to the longitudinal axes are assumed to be simply supported. Arbitrary boundary conditions may be specified on any external longitudinal edge of plate-strip elements. The structure or selected elements may be loaded in any desired combination of inplane transverse compression or tension side load and axial compression load. The analysis simultaneously considers all possible modes of instability and is applicable for the buckling of laminated composite structures. Author

N73-26924*# Ohio State Univ., Columbus.
VIBRATION OF SHELLS
Arthur W. Leissa Washington NASA 1973 435 p refs
(NASA-SP-288; LC-77-186367) Avail: NTIS MF $0.95; SOD HC $5.20 Domestic Postpaid or $4.75 GPO Bookstore CSCL 20K

The vibrational characteristics and mechanical properties of shell structures are discussed. The subjects presented are: (1) fundamental equations of thin shell theory, (2) characteristics of thin circular cylindrical shells, (3) complicating effects in circular cylindrical shells, (4) noncircular cylindrical shell properties, (5) characteristics of spherical shells, and (6) solution of three-dimensional equations of motion for cylinders. Author

N73-26925*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GENERAL CONSIDERATIONS FOR STRUCTURAL INSPECTION OF OLDER AIRCRAFT
Herbert F. Hardrath Washington Jul. 1973 11 p refs
(NASA-TM-X-2845; L-9187) Avail: NTIS HC $3.00 CSCL 01C

Generalized considerations for structural inspections needed to maintain airworthiness of older aircraft are reviewed. Recommendations are made to account for accumulated service usage by counting flights rather than flight hours, to inspect structures made of flaw-sensitive materials more frequently than those made of flaw-tolerant materials, and to inspect structures having little redundancy more frequently than those having more redundancy. Occasional destructive inspections of high-time aircraft are suggested as being useful, but expensive, sources of either continued confidence or impending problems. Author

N73-26926*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BUCKLING TESTS OF TWO 4.6-METER-DIAMETER, MAGNESIUM RING-STIFFENED CONICAL SHELLS LOADED UNDER EXTERNAL PRESSURE
James Kent Anderson and Davis R. C. Washington Jul. 1973 68 p refs
(NASA-TN-D-7303; L-8835) Avail: NTIS HC $3.00 CSCL 20K

Two ring-stiffened magnesium conical shells with a 120 deg apex angle and a 4.6-meter diameter were loaded to failure by a uniform external pressure. The cones differed from one another only in the number of internal stiffening rings. Test specimen details, test procedure, and test results are discussed. Both buckling and prebuckling data are compared with appropriate theoretical predictions. Measured strains in skin and rings agreed well with theoretical predictions. Extensive imperfection measurements were made and reported on both cones in the as fabricated condition. Author

N73-26927*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AUTOMATED PROCEDURE FOR DESIGN OF WING STRUCTURES TO SATISFY STRENGTH AND FLUTTER REQUIREMENTS
Raphael T. Haftka Washington Jul. 1973 34 p refs
(NASA-TN-D-7264; L-8592) Avail: NTIS HC $3.00 CSCL 01C

A pilot computer program was developed for the design of minimum mass wing structures under flutter, strength, and minimum gage constraints. The wing structure is idealized by finite elements, and second-order piston theory aerodynamics is used in the flutter calculation. Mathematical programing methods are used for the optimization. Computation times during the design process are reduced by three techniques. First, iterative analysis methods used to reduce significantly reanalysis times. Second, the number of design variables is kept small by not using a one-to-one correspondence between finite elements and design variables. Third, a technique for using approximate second derivatives with Newton's method for the optimization is incorporated. The program output is compared with previous published results. It is found that some flutter characteristics, such as the flutter speed, can display discontinous dependence on the design variables (which are the thicknesses of the structural elements). It is concluded that it is undesirable to use such quantities in the formulation of the flutter constraint. Author

N73-26928# Lockheed Missiles and Space Co., Palo Alto, Calif.
RESONANCE PHENOMENA IN THE NONLINEAR VIBRATIONS OF SOLIDS
R. F. Ganiev [1973] 29 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 8, no. 12, 1972 p 45-70
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A solid or system of solids ,subjected to the effect of a definite system or systems of forces is used as the dynamical model in solving many applied problems. An investigation of the nonlinear resonance phenomena in systems of solids having rotating and vibrating parts was performed. The equations of vibrational motion of a solid in a potential field of elastic forces are analyzed. Resonance phenomena in satellite vibrational and rotational motion are investigated. Periodic and almost periodic three-dimensional oscillations of a solid are examined mathematically. Author

N73-26929# Lockheed Missiles and Space Co., Palo Alto, Calif.
STABILITY OF SHELLS WEAKENED BY HOLES
Iu. A. Ashmarin and A. N. Guz [1973] 16 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 9, no. 4, 1973 p 3-15
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A survey of theoretical and experimental investigations of the stability of shells weakened by holes was conducted. The complexity of the solution of the stability problem is characterized by the fact that a significant stress redistribution due to the interaction between two fields is possible long before the critical value of the loading is reached. The difficulty of the solution is aggravated by the fact that the separation of the stress state into the sum of two states, is not possible. Specific examples for various configurations of shells with mathematical models of the stress analysis are presented. Author

N73-26930# Lockheed Missiles and Space Co., Palo Alto, Calif.
DYNAMIC STABILITY OF AN ELASTIC ORTHOTROPIC CYLINDRICAL SHELL TAKING ACCOUNT OF TRANSVERSE SHEARS
A. E. Bogdanovich [1973] 9 p refs Transl. into ENGLISH from Mekh. Polimerov, Akad. Nauk Latv. (Riga), no. 2, 1973 p 312-350
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The governing equations of the dynamic stability of an elastic orthotropic cylindrical shell are obtained by refined theories of Timoshenko and Ambartsumian type. The instability domains obtained by the refined and classical theories are compared. Dependences of the refinement quantities on the shell parameters, the shear moduli of the material, and the buckling mode are presented. Author

N73-26931*# Boeing Co., Seattle, Wash. Aerospace Group.
FRACTURE AND CRACK GROWTH RESISTANCE STUDIES OF 304 STAINLESS STEEL WELDMENTS RELATING TO RETESTING OF CRYOGENIC VESSELS
L. R. Hall and R. W. Finger Dec. 1972 58 p refs
(Contract NAS3-12003)
(NASA-CR-121025; D-180-15220-1) Avail: NTIS HC $5.00 CSCL 20K

Fracture and crack growth resistance characteristics of 304 stainless steel alloy weldments as relating to retesting of cryogenic vessels were investigated. Welding procedures were typical of those used in full scale vessel fabrication. Fracture resistance survey tests were conducted in room temperature air, liquid nitrogen and liquid hydrogen. In air, both surface-flawed and center-cracked panels containing cracks in weld metal, fusion line, heat-affected zone, or parent metal were tested. In liquid nitrogen and liquid hydrogen, tests were conducted using center-cracked panels containing weld centerline cracks. Load-unload, sustained load, and cyclic load tests were performed in air or hydrogen gas, liquid nitrogen, and liquid hydrogen using surface-flawed specimens containing weld centerline cracks. Results were used to evaluate the effectiveness of periodic proof overloads in assuring safe and reliable operation of over-the-road cryogenic dewars. Author

N73-26932*# Lehigh Univ., Bethlehem, Pa.
A NOTE ON THE INTERFERENCE OF TWO COLLINEAR CRACKS IN A CYLINDRICAL SHELL
F. Erdogan and M. Ratwani Feb. 1973 8 p refs
(Grant NGR-39-007-011)
(NASA-CR-132271; NASA-TR-73-3; IFSM-73-31) Avail: NTIS HC $3.00 CSCL 20K

A stress analysis of a pressurized shallow cylindrical shell containing two collinear axial cracks of equal length was conducted. The mathematical relationships for conducting the stress analysis are developed. Graphs are presented to show the stress intensity factor ratio in the cylindrical shell and the bending components of the stress intensity factor ratio. Author

N73-26933*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
CONTACT PROBLEM FOR AN ELASTIC REINFORCEMENT BONDED TO AN ELASTIC PLATE
F. Erdogan and M. B. Civelek Feb. 1973 21 p refs
(Grants NGR-39-007-011; NSF GK-11977)
(NASA-CR-132273; NASA-TR-73-1; IFSM-73-29) Avail: NTIS HC $3.25 CSCL 20K

The stiffening layer is treated as an elastic membrane and the base plate is assumed to be an elastic continuum. The bonding between the two materials is assumed to be either one of direct adhesion or through a thin adhesive layer which is treated as a shear spring. The solution for the simple case in which both the stiffener and the base plate are treated as membranes is also given. The contact stress is obtained for a series of numerical examples. In the direct adhesion case the contact stress becomes infinite at the stiffener ends with a typical square root singularity for the continuum model, and behaving as a delta function for the membrane model. In the case of bonding through an adhesive layer the contact stress becomes finite and continuous along the entire contact area. Author

N73-26934*# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
THE INCLUSION PROBLEM WITH A CRACK CROSSING THE BOUNDARY
F. Erdogan and G. D. Gupta Mar. 1973 24 p refs
(Grant NGR-39-007-011; NSF GK-11977)
(NASA-CR-132272; NASA-TR-73-5; IFSM-73-34) Avail: NTIS HC $3.25 CSCL 20K

The problem of an elastic plane containing an elastic inclusion is considered. It is assumed that both the plane and the inclusion contain a radial crack and the two cracks are collinear. The problem is formulated in terms of a system of singular integral equations. In the interesting limiting cases in which the crack tips approach the interface from either one or both sides, the dominant parts of the kernels become generalized Cauchy kernels giving rise to stress singularities of other than minus 1/2 power. For these unusual cases of a crack terminating at or crossing the interface stress intensity factors are defined and some detailed results are given for various crack-inclusion geometries and material combinations. Author

N73-26935# Bettis Atomic Power Lab., Pittsburgh, Pa.
RELATIONSHIP BETWEEN FAILURE STRAINS IN BURST TESTS ON ZIRCALOY TUBING AND WALL THICKNESS ECCENTRICITY LWBR Development Program
E. Duncombe Jan. 1973 24 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-1104) Avail: NTIS

The effects of wall thickness variation on the diametral strain reached in a pressure burst test are analyzed on the basis of two separate mechanisms, namely strain rate sensitivity and strain hardening. Simple methods of correcting the observed strain to a standard value of wall thickness variations are developed.
Author (NSA)

N73-26936# Hanford Engineering Development Lab., Richland, Wash.
FRACTURE AND TENSILE PROPERTIES OF IRRADIATED A533 PRESSURE VESSEL PLATE AND SUBMERGED-ARC

WELD
J. A. Williams 1972 12 p refs Presented at 6th Ann. Inform. Meeting on Heavy Sect. Steel Technol. Program, Oak Ridge, Tenn., 25-26 Apr. 1972
(Contract AT(45-1)-2170)
(HEDL-SA-387; Conf-720468-1) Avail: NTIS

The determination of the effects of irradiation on the fracture and strength properties of pressure vessel steel has been the primary objective of the Hanford Engineering Development Laboratory work in support of the HSST program. The material of interest is ASTM A533 Grade B Class I steel from HSST plate 02 and HSST weldment 51. Characterization of embrittlement by irradiation was evaluated by plane strain fracture toughness, measurements using one-inch thick compact tension (CT) specimens. Tensile properties were studied in detail to determine the material sensitivity to the range of test temperatures and irradiation fluences of interest to reactor pressure vessel steel. Author

N73-26937# Hanford Engineering Development Lab., Richland, Wash. Heavy Section Steel Technology Program.
IRRADIATION EFFECTS ON FRACTURE OF HEAVY SECTION PRESSURE VESSEL STEELS Semiannual Progress Report, period ending 31 Aug. 1972
J. A. Williams and L. A. James 23 Oct. 1972 18 p refs
(Contract AT(45-1)-2170)
(HEDL-SA-497) Avail: NTIS

The fatigue-crack propagation behavior of A533-B steel was studied within the framework of linear-elastic fracture mechanics. In general, at the cyclic frequency used (600 cpm), neither temperature nor neutron irradiation had a significant effect on the fatigue-crack propagation. Fracture properties were evaluated by plane strain and lower bound equivalent energy measurements for irradiated A533 weldment from the HAZ and fusion line and for A533 base plate material. The lower bound of 2 x 10 to the 19th power n/sq cm (E > 1 MeV) fusion line material was 175 ksi-in to the 1/2 power at test temperature above 250 F; baseplate material, at similar irradiation and test conditions exhibited a KicI of approximately 190 ksi-in to the 1/2 power. Author (NSA)

N73-26938# Japan Atomic Energy Research Inst., Tokai. Tokai Research Establishment.
FATIGUE OF PRESSURE VESSEL IN HIGH TEMPERATURE AQUEOUS ENVIRONMENT
T. Kondo 1972 23 p refs In JAPANESE; ENGLISH summary Presented at INCO Power Conf., Kyoto, 28 Nov. 1972
(Conf-721104-6; Paper-9) Avail: AEC Depository Libraries

Fatigue behavior of reactor pressure vessel steels in high temperature aqueous environment was studied. Some factors affecting crack growth characteristics of these steels, e.g., stress or strain conditions, temperature, and loading frequency were investigated. The crack growth rate in high temperature aqueous environment, as well as in ambient air environment, was strongly dependent on the stress, but the growth characteristics were substantially different. The crack growth rate in aqueous environment was also greatly influenced by temperature and loading frequency. Prediction of the life of full-size pressure vessels under corrosive condition applying specimen data was proposed. Author (NSA)

N73-26939# Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
THERMO-ELASTIC DEFORMATIONS IN A HOLLOW NONCIRCULAR CYLINDER
R. J. M. Crozier Nov. 1972 74 p
(AECL-4308) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River $2.00

A numerical technique is described that is used to determine the thermo-elastic deformations experienced by a segment of a hollow, noncircular cylinder whose inner and outer surfaces are subjected to temperatures, radial and tangential displacements, and normal and shear pressures, all of which may vary around the circumference of the cylinder. The report is intended as a users' manual for the FORTRAN program CHANTER which has been written to carry out the necessary computations. The problem ofthe determination of the thermo-elastic stresses in an out-of-round fuel sheath whose inner surface is deformed by a cracked fuel pellet is used as an illustration. Author (NSA)

N73-26940# Ecole Nationale Superieure des Mines, Paris (France). Groupe Commun de Recherche en Materiaux.
STUDY OF THE BUCKLING OF COMPOSITE MATERIALS Final Report [ETUDE DU FLAMBEMENT DE STRUCTURES EN MATERIAUX COMPOSITES RAPPORT DE SYNTHESE]
G. Verchery 1973 47 p refs In FRENCH; ENGLISH summary Sponsored by Direc. des Rech. et Moyens d'Essais Prepared jointly with Ecole Natl. Super. De Tech. Avanchees Prepared for Assoc. pour la Rech. et le Develop. des Methodes et Processus Ind.
(ENSMP-010) Avail: NTIS HC $4.50

Methods for the determination of composite (boron or glass fibers in an epoxy or aluminum matrix) column and square plate critical loads are presented. The compression loaded structures were studied by the static Southwell plot method and a dynamic method measuring the variations of transverse natural frequencies. It was found that both methods were accurate, however the static method was less sensitive to structural imperfections. In case of columns, the study was completed by a theoretical analysis adding a correction term due to the transverse shear to the existing equations. ESRO

N73-26941# National Aerospace Lab., Amsterdam (Netherlands).
FINITE ELEMENT CALCULATIONS OF THE COMPLIANCE OF A TAPERED DOUBLE CANTILEVER BEAM SPECIMEN FOR DIFFERENT CRACK CONFIGURATIONS
H. H. Ottens and C. J. Lof 1 Jul. 1972 27 p refs
(NLR-TR-72083-U) Avail: NTIS HC $3.50

A series of finite element calculations was carried out to investigate the influence of crack configurations (sharp and blunted) on the compliance of a tapered double cantilever beam specimen. Experimental data were obtained for both crack types. Finally, the compliance data were used to determine the crack extension force, and to check the supposedly negligible variation of this force with the crack length. ESRO

N73-26942# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Drehfluegler.
INTRODUCTION TO THE CALCULATION METHOD OF FIBER REINFORCED PLASTIC CONSTRUCTIONS [EINFUEHRUNG IN DIE BERECHNUNGSMETHODEN FUER KONSTRUKTIONEN AUS FASERVERSTAERKTEM KUNSTSTOFF]
Fritz Och 14 Feb. 1972 37 p In GERMAN Presented at the Course on Konstruieren mit GFK, Esslingen, West Ger., 1-3 Mar. 1972
(MBB-UD-79-72-O) Avail: NTIS HC $4.00

The analysis of structures based on glass fiber reinforced laminates is dealt with. The laminate is symmetrically structured with regard to its median plane, and loaded by a plane stress condition (membrane stress condition), the resultants of which lie in the median plane. The most important relations for the net and continuum theory are indicated and applied to the dimensioning of a pressure vessel, designed for maximal burst pressure, and a pipe under torsional stress. ESRO

N73-26943# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft-und Raumfahrtkonstruktionen.
NON-LINEAR OSCILLATIONS USING THE FINITE ELEMENT TECHNIQUE
J. H. Argyris, P. C. Dunne, and T. Angelopoulos Nov. 1972 67 p refs Sponsored by Deut. Forschungsgemeinschaft Prepared jointly with Imperial Coll. of Sci. and Technol.
(ISD-136) Avail: NTIS HC $5.50

The finite element method with a cubic interpolation of the inertia forces is developed for the solution of problems in structural dynamics with a nonlinear stiffness. Algorithms are given for the direct iterative solution of equations of motion and their solution by piecewise linearization. Several ways of implementing the algorithm are discussed and a direct iterative solution is shown to be the most economical and accurate for large systems of over 600 freedoms. For moderate sized systems (300 freedom), an incrementally linearized solution using a modified tangent stiffness matrix is developed. Other variations of the integrating

procedure are given which combine incremental linearization with direct iteration. A number of numerical examples of non-linear structures are calculated and, in some cases, comparison with other methods is made. ESRO

N73-26944# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
BUCKLING OF FIBER-REINFORCED CIRCULAR CYLINDERS UNDER AXIAL COMPRESSION Final Report
R. C. Tennyson, D. B. Muggeridge, K. H. Chan, and N. S. Khot Aug. 1972 128 p refs Prepared in cooperation with Toronto Univ.
(AF Proj. 1467)
(AD-759537; AFFDL-TR-72-102) Avail: NTIS CSCL 20/1

A combined analytical and experimental program was undertaken to determine design criteria for accurately predicting the buckling strength of laminated composite cylindrical shells. An analytical solution for the buckling load was obtained by using Koiter's theory for axisymmetric and asymmetric imperfections. For axisymmetric imperfections, numerical evaluations were carried out for the case of three-ply composite shells of glass, boron and graphite-epoxy construction with fiber orientations, 0, 0, -0 degrees. It was found that drastic buckling load reductions occurred comparable to isotropic shells For each small values of imperfection amplitudes. For cylindrical shell, test model fabricated from three ply preimpregnated glass-epoxy, an equivalent imperfection amplitude was computed by using the root mean square imperfection measurements obtained from several generators. Fairly good agreement was found between the analytically predicted and experimental buckling loads.
Author (GRA)

N73-26945# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNIVERSITY STUDIES ON THE THEORY OF PLATES AND SHELLS (SELECTED ARTICLES)
Yu. G. Konoplev and A. V. Konkin 28 Mar. 1973 32 p refs Transl. into ENGLISH from Issled. po Teorii Plastin i Obolochek (USSR), no. 7, 1970 p 481-500
(AD-759391; FTD-MT-24-1514-72) Avail: NTIS CSCL 20/11

Contents: Experimental study of the stability of a cylindrical shell, under the action of an arbitrary number of local axial forces; The action of concentrated forces and moments on a cylindrical shell reinforced by a band. GRA

N73-26946# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
VIBRATIONS OF A STIFFENED COMPOSITE SHELL
J. M. Klosner, M. L. Pollack, and Y. N. Chen Mar. 1973 49 p refs
(Contract N00014-67-A-0438-0006; NR Proj. 064-427)
(AD-759375; PIBAL-73-3) Avail: NTIS CSCL 13/13

The natural frequencies and modes have been obtained for a stiffened and unstiffened composite shell composed of a cylinder with spherical end caps. Comparison of these are made to those obtained for an unreinforced cylindrical shell having various edge conditions. The results indicate that at the higher circumferential wave numbers, the frequencies of the unreinforced shell are independent of the end conditions. The frequencies of the ring-stiffened composite shell lie between the corresponding frequencies of the unstiffened shell and that of the isolated ring stiffener for circumferential wave numbers m greater than or equal to 1. Above a critical circumferential wave number, the stiffeners raise the value of the frequencies while below that number, they reduce their values. Author (GRA)

N73-26947# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORETICAL-EXPERIMENTAL METHOD OF INVESTIGATING THE STABILITY OF PLATES AND SHELLS
A. V. Sachenkov 28 Mar. 1973 61 p refs Transl. into ENGLISH form Issled. Teor. Plastin Obolochek (Kazan), no. 7, 1968 p 319-433
(AD-759242; FTD-MT-24-1513-72) Avail: NTIS CSCL 20/11

The methods of similarity and dimensionality are applied to the solution of a series of problems concerning the strength of plates and shells. GRA

N73-26948# State Univ. of New York, Buffalo. Dept. of Engineering Science.
HIGH FREQUENCY VIBRATIONS OF THIN CRYSTAL PLATES
Raj. K. Kaul Sep. 1972 43 p refs
(Contract N00014-71-C-0108)
(AD-760323; Rept-81) Avail: NTIS CSCL 20/11

Equations of motion of an anisotropic plate are rederived by using a new procedure which first determines the natural concomitants of the variational problem and then shows how the two-dimensional equations can be simplified by using these conditions. Author (GRA)

N73-26949# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
STRESS DISTRIBUTION AROUND AN ELLIPTIC HOLE IN AN INFINITE MICROPOLAR ELASTIC PLATE
Byoung Sung Kim and A. Cemal Eringen Apr. 1973 26 p refs
(Contracts N00014-67-A-0151-0004; DAHC04-69-C-0062; NR Proj. 064-410)
(AD-759964; TR-30) Avail: NTIS CSCL 13/13

The problem of stress distribution in an infinite micropolar plate, weakened by an elliptic hole, subject to a constant uniform tension at infinity perpendicular to the major axis of the elliptic hole is solved. The stress distribution is plotted along the direction of the major axis of the ellipse and stress concentration factors are determined for various material parameters and eccentricities. The results are compared with those of classical elasticity and couple stress theory. Author (GRA)

N73-26950# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RANDOM VIBRATIONS OF DISTRIBUTED SYSTEMS
V. H. Goncharenko 4 May 1973 12 p refs Transl. into ENGLISH from Probl. Nadezhnosti v Stroit. Mekhanike (USSR), Jun. 1968 p 229-234
(AD-759866; FTD-HT-23-232-73) Avail: NTIS CSCL 20/11

Forced vibrations of distributed elastic systems during random loading, as a rule, are studied in linear statement. In nonlinear problems the elastic system is usually replaced by a system with a low number of degrees of freedom. But idealization of the load as a random function is advisable when it is of an irregular, broad-band nature. In this case the large number of forced forms of vibrations does not permit hope for reliability of such an approximation. The report considers nonlinear vibrations of a plate (physical nonlinearity of the material is considered), without reducing it to a system with a finite number of degrees of freedom. The method may also be used to study random vibrations of elastic systems with other nonlinearities. GRA

N73-26951# Cambridge Acoustical Associates, Inc., Mass.
DYNAMIC RESPONSE OF COUPLED SYSTEMS: A COMPARISON BETWEEN STATISTICAL ENERGY AND DETERMINISTIC TECHNIQUES
J. M. Garrelick Sep. 1972 29 p refs
(Contract N00014-69-C-0056; NR Proj. 064-479)
(AD-760276; CAA-U-392-213) Avail: NTIS CSCL 20/11

The problem of two, spring coupled rods subjected to a known longitudinal steady state pure tone excitation is used to compare the statistical energy analysis (SEA) approach with other, more traditional, high frequency formulations. In particular, the Sommerfeld - Watson transformation and the Poisson Summation Formula are interpreted in terms of the SEA point of view. The relevance of these results to more complicated structures is discussed. Author (GRA)

N73-26952# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
SOME EXPERIMENTS ON THE DYNAMIC PLASTIC BEHAVIOR OF SHELL INTERSECTIONS
A. B. Summers and Norman Jones Apr. 1973 26 p refs
(Contract N00014-67-A-0204-0032)
(AD-760012; Rept-73-9) Avail: NTIS CSCL 20/11

An experimental investigation into the dynamic plastic behavior of some metal shell intersections is reported herein. The models consist of a cylindrical nozzle intersecting a hemispherical shell which is subjected to a uniformly distributed

internal impulsive velocity field. The magnitude of the initial kinetic energy of the dynamic load is sufficient to cause inelastic behavior and small permanent displacements. Author (GRA)

N73-26953# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYPOTHESIS OF SPECTRAL ADDITION AND ITS APPLICATION TO DETERMINATION OF ENDURANCE UNDER RANDOM LOADS
V. L. Raikher 4 May 1973 12 p refs Transl. into ENGLISH from the monograph "Problemy Nadezhnosti v Stroitelnoi Mekhanike" Jun. 1968 p 267-273
(AD-759869; FTD-HT-23-227-73) Avail: NTIS CSCL 20/11

Random loads are one of the most wide-spread types of loads which affect the construction of machines, mechanisms and buildings. Generally accepted methods of computing the endurance are based on the hypothesis of linear accumulation of fatigue damage, the correctness of which is in doubt for many cases of loading. Especially considerable difficulties show up in cases of random loads, since the concept of a cycle of variable loading in this case is by far not unambiguous. Depending upon the means of cycle-formation the computed values of endurance for certain types of loads will differ by factors of ten. The report proposes an approach to the determination of endurance under random loads, avoiding the cited difficulties. The theory was developed in application to the standard normal loading process. GRA

N73-26954# California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
DYNAMIC BUCKLING OF STRUCTURES Final Report
Prem Bhatia and Charles D. Babcock, Jr. Feb. 1973 66 p refs
(Grant AF-AFOSR-1424-68; AF Proj. 9782)
(AD-760158; GALCIT-SM-73-1; AFOSR-73-0776TR) Avail: NTIS CSCL 20/11

An experimental program to study the applicability of the energy criterion to predict the dynamic response of structures, has been carried out. The sturctures considered are clamped and elastically restrained arches and spherical caps. Their response to time dependent loads like step and impulsive loads has been studied and compared to the analytical results from the energy analysis. In most cases, the results are in fair agreement and indicate the effect of initial imperfections and energy dissipation on dynamic buckling. Dissipation of energy and its effects on dynamic response, are further studied in a theoretical and experimental analysis of a viscoelastic beam and a circular plate. The analytical and test results point to the mechanisms by which damping affects the dynamic response of structures.
Author (GRA)

N73-26955# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ACCELERATION WAVES IN SIMPLE ELASTIC MATERIALS
T. W. Wright Mar. 1973 86 p refs
(DA Proj. 1T0-61102-B-33A)
(AD-760438; BRL-1640) Avail: NTIS CSCL 20/11

The classical method of characteristic surfaces and bicharacteristic rays is used to study acceleration and higher order discontinuities in nonlinear simple elastic materials. No special material symmetry is assumed, and the analysis requires neither material homogeneity nor uniform conditions ahead of the wave in general, although many detailed results do require the latter two conditions. This paper draws heavily on known results, but at the same time many other results, believed to be new, have been included. Analysis of the motion of the singular surface precedes a discussion of the amplitude equations. It is shown that the Jacobian determinant of a certain coordinate transformation induced by the motion of the surface, plays a dominant role in the equations for transport of amplitude. New results on the kinematics of singular surfaces are given for homogeneous and uniform materials, including a formula for the evolution of surface curvature in anisotropic materials, and a complete description of the role of the curvatures of the initial singular surface and of the characteristic slowness surface in producing expansion or focusing of the singular surface. (Author Modified Abstract) GRA

N73-26956# State Univ. of New York, Buffalo. Dept. of Engineering Science.
WAVE FRONT STRESS RELAXATION IN NONLINEAR VISCOELASTIC MATERIALS WITH RANDOM TEMPERATURE DISTRIBUTIONS
F. A. Cozzarelli and W. P. Chang Feb. 1973 44 p refs
(Contract N00014-71-C-0108; Grant NSF GK-1834)
(AD-760324; Rept-88) Avail: NTIS CSCL 20/11

Analytical and numerical solutions are presented for the statistical properties of the stress at the wave front in a suddenly loaded semi-infinite rod of a nonlinear viscoelastic material. The temperature and accordingly the temperature sensitive material parameters are assumed to be random. Author (GRA)

N73-26957# State Univ. of New York, Buffalo. Dept. of Engineering Science.
ON THE HIGH FREQUENCY EXTENSIONAL VIBRATIONS OF ISOTROPIC, ELASTIC PLATES
L. C. Billman and R. K. Kaul Apr. 1973 60 p refs
(Contract N00014-71-C-0108)
(AD-760325; Rept-89) Avail: NTIS CSCL 20/11

Extensional equations of motion of an isotropic, elastic plate are derived by using expansion in terms of complete set of Legendre polynomials. The natural conditions used are the variational concomitants of the Euler's equations of motion.
Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-26958* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DISCONNECT UNIT Patent
Paul Alexander, Jr. and Allan R. McDougal, inventors (to NASA) Issued 5 Jun. 1973 7 p Filed 24 Feb. 1971 Supersedes N71-35154 (09 - 21, p 3530) Sponsored by NASA
(NASA-Case-NPO-11330; US-Patent-3,737,181; US-Patent-Appl-SN-118269; US-Patent-Class-285-316; US-Patent-Class-285-DIG.21) Avail: US Patent Office CSCL 19A

A squib-actuated disconnect is characterized by an expandable collet axially extended from a first tension member for receiving in locking engagement a protuberance axially extended from a second tension member. A gas-driven retainer of an annular configuration is also locked in for supporting the collet in locking engagement with the protuberance. The protuberance is axially displaced in response to a firing of an associated squib for thus accommodating a disengagement of the protuberance and the collet. Official Gazette of the U.S. Patent Office

N73-26959*# Hamilton Standard, Windsor Locks, Conn.
ANALYSIS AND TEST OF A BREADBOARD CRYOGENIC HYDROGEN/FREON HEAT EXCHANGER Technical Report, 12 May 1972 - 24 Jan. 1973
L. F. Desjardins and J. Hooper Apr. 1973 124 p refs
(Contract NAS9-12725)
(NASA-CR-128987; SVHSER-6180) Avail: NTIS HC $8.25 CSCL 20M

System studies required to verify a tube-in-tube cryogenic heat exchanger as optimum for the space shuttle mission are described. Design of the optimum configuration, which could be fabricated from commercially available hardware, is discussed. Finally, testing of the proposed configuration with supercritical hydrogen and Freon 21 is discussed and results are compared with thermal and dynamic analysis. Author

N73-26960# National Research Council of Canada, Ottawa (Ontario).
OBSERVATION OF ERRORS IN THE CALCULATION OF THERMODYNAMIC EQUILIBRIA

Kl.-K. Neumann 1973 13 p refs Transl. into ENGLISH from Ber. Bunsenges. Phys. Chem. (West Germany), v. 67, no. 4, 1963, p 373-377
(NRC-TT-1665) Avail: NTIS HC $3.00

A linear system of equations is given which allows the errors of volume fractions or partial pressures at the calculated equilibrium compositions to be computed for given errors in the equilibrium constant. It is shown that it is useful to use relative errors in these calculations. The total relative error of each volume fraction is a sum total of relative errors, each of which is caused by the error in one equilibrium constant. A proof is given that every relative error in a volume fraction must be smaller than the sum total of the relative errors of the equilibrium constants. This proof applies to the most important types of reactions if the equilibrium conditions are formulated in such a manner that there are no fractional exponents. Author

N73-26961*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
THEORETICAL ANALYSIS OF A ROTATING TWO-PHASE DETONATION IN A ROCKET MOTOR
I-wu Shen and T. C. Adamson, Jr. Mar. 1973 63 p refs
(Grant NGL-23-005-336)
(NASA-CR-121194) Avail: NTIS HC $5.25 CSCL 21B

Tangential mode, nonlinear wave motion in a liquid propellant rocket engine is studied, using a two phase detonation wave as the reaction model. Because the detonation wave is followed immediately by expansion waves, due to the side relief in the axial direction, it is a Chapman-Jouguet wave. The strength of this wave, which may be characterized by the pressure ratio across the wave, as well as the wave speed and the local wave Mach number, are related to design parameters such as the contraction ratio, chamber speed of sound, chamber diameter, propellant injection density and velocity, and the specific heat ratio of the burned gases. In addition, the distribution of flow properties along the injector face can be computed. Numerical calculations show favorable comparison with experimental findings. Finally, the effects of drop size are discussed and a simple criterion is found to set the lower limit of validity of this strong wave analysis. Author

N73-26962# National Aviation Facilities Experimental Center, Atlantic City, N.J.
THE USE OF GROUND COVER MATERIALS TO SUPPRESS FUEL SPILL FIRES Final Report, Jul. - Oct. 1972
George B. Geyer, Lawrence M. Neri, and Charles H. Urban Jul. 1973 21 p refs
(FAA Proj. 081-431-030)
(FAA-NA-73-13; FAA-RD-73-74) Avail: NTIS HC $3.25

Small-scale experiments were conducted to determine the effectiveness of crushed and graded stone aggregate in preventing or retarding the rate of flame propagation from a fixed-ignition source when it was employed as a simulated ground cover material under controlled experimental conditions, for each of three aviation fuels. Tests included the use of loosely packed aggregate and no-fines concrete made with the same material. No significant difference in the rate of flame spread was noted between the loosely packed aggregate and no-fines concrete under equivalent test conditions. The experiments showed that the effectiveness of an aggregate in retarding flame propagation was a function of its size and the flash point of the hydrocarbon fuel and of its depth below the surface of the simulated ground cover. The fire suppression and/or containment effectiveness of the ground cover materials increased as the size of the aggregate decreased and the flash point of the fuel increased and as the depth of the fuel below the surface of the stone increased. Author

N73-26963# Denver Research Inst., Colo. Mechanical Sciences and Environmental Engineering Div.
METAL FUEL CANDIDATES FOR PYROTECHNIC COMPOSITIONS Quarterly Report, 26 Jun. - 26 Sep. 1972
Robert M. Blunt 1 Mar. 1973 55 p refs
(Contract N00164-72-C-0605)
(AD-759761; DRI-4793-7209-Q; NAD-CR-RDTR-235) Avail: NTIS CSCL 19/1

The report is a bibliography which contains literature and U.S. patent references to alloys of aluminum with magnesium, zinc, the alkali or alkaline earth metals or combustions of these. Applications to pyrotechnics and/or explosives have been the major source of patent references, while the literature survey has covered a wider range. No claim to completeness is made; it is hoped this compilation will be useful to others seeking data on metallic fuels for pyrotechnic compositions.
Author (GRA)

N73-26964# Naval Postgraduate School, Monterey, Calif.
ENTROPY AND TEMPERATURE
Oscar Biblarz Dec. 1972 29 p refs
(AD-759970; NPS-57ZI72121A) Avail: NTIS CSCL 20/13

The article is written in the style of Scientific American. A minimum of mathematics is used in the presentation of a new approach to the understanding of the Second Law of thermodynamics. The intended readers are engineering students who have been exposed to a standard version of undergraduate thermodynamics (such as AE 2042). It is shown here that, by extending the use of entropy and of temperature to nonequilibrium situations, a more complete formulation of the Second Law is possible. Applications of the foregoing concept to fluid flow, to chemical reactions, and to lasers are presented.
Author (GRA)

N73-26965# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
POSSIBLE CONDENSATION IN ROCKET EXHAUST PLUMES, SUPPLEMENT
Benjamin J. C. Wu Sep. 1972 55 p refs Reprinted
(Contract F04611-72-C-0013)
(AD-760040) Avail: NTIS CSCL 21/2

The results of a computational investigation of possible condensation in the exhaust plume of a specific rocket engine are reported. The exhaust considered is a chemically frozen gas mixture of CO, CO2, H2O, and H2. It was found that only H2O may condense since the other species did not become saturated in the flow field. Possible condensation onset of H2O by homogeneous nucleation has been estimated using the so-called classical steady-state theory, some ideas on the statistical mechanics contributions, and empirical modifications based on previous experiments. (Author Modified Abstract) GRA

N73-26966# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
POSSIBLE CONDENSATION IN ROCKET EXHAUST PLUMES 2
Benjamin J. C. Wu Apr. 1973 45 p refs
(Contract DAAH01-73-C-0442; ARPA Order 1179)
(AD-760039) Avail: NTIS CSCL 21/2

The results of a computational study of one aspect of condensation in the exhaust plume consisting of H20 and H2 of an Apollo rocket engine are reported. Saturation of water vapor occurs at about 225 K in the plume. Hydrogen remains unsaturated in the given flow field. Under the assumption of steady state nucleation, onset of H20 condensation by homogeneous nucleation is estimated to accur at x = 47, 40, and 13 m, i.e., about 45, 38, and 13 m down stream of the nozzle exit plane, along theta = 0.0, 0.3, and 0.8 stream tubes respectively. It is further estimated that at x = 150 m along the center stream tube, a cloud of 10 to the 10th power H20 droplets/cu cm is formed. The mass mean radius of this cloud of droplets is about 17 A. Author

N73-26967# Army Foreign Science and Technology Center, Charlottesville, Va.
STUDY OF THE RELATIONSHIPS GOVERNING THROUGH RADIATIVE HEAT EXCHANGE
A. Netal Minaev 9 Mar. 1973 9 p refs Transl. into ENGLISH from Uch. Zap., Mosk. Obl. Ped. Inst. (Moscow), no. 172, 1969 p 287-293
(AD-760399; FSTC-HT-23-1972-72) Avail: NTIS CSCL 20/13

The problem of protecting against thermal radiation is considered and the quantitative relations in the shielding of bodies are examined. A laboratory set-up was constructed and experimental methods developed for determining the effect of shields on radiative heat transfer. The methodology and equipment used are described together with the results obtained. D.L.G.

N73-26968# Physical Dynamics, Inc., Berkeley, Calif.
HIGH ALTITUDE ROCKET PLUME STRUCTURE: EXPERIMENT AND CALCULATIONS
Frederick P. Boynton Jun. 1972 25 p refs
(Contract F19628-72-C-0006; ARPA Order 1856; AF Proj. 8692)
(AD-759838; PD-72-022; AFCRL-72-0680; SR-1) Avail: NTIS CSCL 16/4

Values of impact pressure and species number density measured in a wind tunnel experiment simulating a high-altitude rocket exhaust plume are compared with values calculated with a computer code. Considering a number of uncertainties in the absolute calibrations of the experiment, agreement is generally considered satisfactory for conditions in the mixing region between plume and free stream gases. However, in the forward part of the plume, the data suggests that free-stream gas penetrates further into the plume than the calculation predicts; the cause of this discrepancy is unknown. Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-26969* National Aeronautics and Space Administration, Washington, D.C.
THE INTERNATIONAL SYSTEM OF UNITS: PHYSICAL CONSTANTS AND CONVERSION FACTORS. SECOND REVISION
E. A. Mechtly (Illinois Univ. Urbana) 1973 23 p refs Revised
(NASA-SP-7012; LC-72-600360) Avail: SOD HC $0.50 Domestic Postpaid or $0.35 GPO Bookstore CSCL 05B

Data, covering the physical constants, conversion factors, names, symbols, and definitions in the International System of Units are presented. E.H.W.

N73-26970# National Research Council of Canada, Ottawa (Ontario).
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 JANUARY - 31 MARCH 1973
31 Mar. 1973 92 p refs
(DME/NAE-1973(1)) Avail: NTIS HC $6.75

Research projects conducted by the National Aeronautical Establishment and the Divison of Engineering in Canada are discussed. The specific items presented are: (1) subspan oscillation of bundled power conductors, (2) jet fuel specifications, (3) very low frequency navigation developments, and (4) dispersion of airborne pollutants in the lower atmosphere. A listing of projects being conducted in various laboratories of the organization is included. For individual titles, see N73-26971 through N73-26974.

N73-26971 National Aeronautical Establishment, Ottawa (Ontario). Low Speed Aerodynamics Lab.
OBSERVATIONS ON THE PROBLEM OF SUBSPAN OSCILLATION OF BUNDLED POWER CONDUCTORS c01
R. L. Wardlaw, K. R. Cooper, and R. H. Scanlan (Princeton Univ.) *In* Natl. Res. Council of Can. Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeronaut. Est. 31 Mar. 1973 p 1-20 refs Reprinted Presented at Intern. Symp. on Vibration Probl. in Ind., England, 10-12 Apr. 1973 (For availability see N73-26970 17-34)

Experimental and analytical investigations into the problem of the aerodynamically induced oscillations of bundled power conductors are described. The mean aerodynamic forces on the conductors have been measured in wind tunnels for 2, 4, 6 and 8 conductor bundles using two-dimensional full scale models. Dynamic response studies have been made using spring-mounted two-dimensional full-scale models and reduced scale aeroelastic models. Using the measured force data the quasi-steady, linearized analytical approach has been shown to give reasonable predictions of the conditions for instability and the initial amplitude buildup rates. A conductor can become unstable only in a narrow region of the wake of an up stream conductor. Outside this region there is a high level of positive aerodynamic damping. Author

N73-26972 National Research Council of Canada, Ottawa (Ontario). Fuels and Lubricants Lab.
JET FUEL SPECIFICATIONS c27
L. Gardner and R. B. Whyte *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeronaut. Est. 31 Mar. 1973 p 21-34 refs (For availability see N73-26970 17-34)

Various military and civil jet fuel specifications are compared and their differences noted, particularly with reference to different types of additives which are used on a mandatory or optional basis. Specification test procedures and their importance in relation to limits are discussed and the increased complexity of quality control over the years since the first jet fuel specifications is noted. Author

N73-26973 National Aeronautical Establishment, Ottawa (Ontario). Flight Research Lab.
VLF NAVIGATION DEVELOPMENT AT NAE c21
C. D. Hardwick *In* Natl. Res. Council of Can. Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeronaut. Est. 31 Mar. 1973 p 35-43 refs (For availability see N73-26970 17-34)

Airborne very low frequency navigation systems in the context of both the Omega Navigation System and a system using very low frequency communications stations are discussed. An airborne mechanization of each system is presented. Results and comparison of performance tests of the two systems are provided. The potential of airborne very low frequency navigation as a no-cost alternative to line of sight navigation for remote areas is emphasized. Author

N73-26974 National Aeronautical Establishment, Ottawa (Ontario). Unsteady Aerodynamics Lab.
THE DISPERSION OF AIRBORNE POLLUTANTS IN THE LOWER ATMOSPHERE c20
R. S. Crabbe *In* Natl. Res. Council of Can. Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeronaut. Est. 31 Mar. 1973 p 45-61 refs (For availability see N73-26970 17-34)

The effect of atmospheric stability on the vertical spread of airborne pollutants from steady and instantaneous sources in the constant-stress region is discussed. Computer results are presented for a ground-based steady source and, as an approximation to aerial spraying, for a two-dimensional puff source over a forest. A comparison is drawn with field data, in the case of the steady source, over a representative range of atmospheric stability. Author

N73-26975*# TRW Systems Group, Houston, Tex. Systems Evaluation Dept.
APPLICABILITY OF LAND USE MODELS FOR THE HOUSTON AREA TEST SITE Final Report
R. K. Petersburg and L. H. Bradford 29 Jun. 1973 182 p
(Contract NAS9-13081)
(NASA-CR-128991) Avail: NTIS HC $11.25 CSCL 08B

Descriptions of land use models are presented which were considered for their applicability to the Houston Area Test Site. These models are representative both of the prevailing theories of land use dynamics and of basic approaches to simulation. The models considered are: a model of metropolis, land use simulation model, emperic land use forecasting model, a probabilistic model for residential growth, and the regional environmental management allocation process. Sources of environmental/resource information are listed. Author

N73-26976*# Scientific Translation Service, Santa Barbara, Calif.
LUMIDUC ARCHITECTURE
Guy Rottier Washington NASA 29 Jun. 1973 11 p Transl. into ENGLISH from the French report Bull-22
(Contract NASw-2483)
(NASA-TT-F-14963; Bull-22) Avail: NTIS HC $3.00 CSCL 13B

A new concept of architecture for urban design is discussed.

The design enables solar rays to be captured and directed by means of reflection through channels to the interior of a dwelling, thereby foregoing the necessity of rooms having an outside exposure for solar illumination. Author

N73-26977# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, SPACE SCIENCE, VETERANS, AND CERTAIN OTHER INDEPENDENT AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1974. PART 2: FEDERAL COMMUNICATIONS COMMISSION, FEDERAL HOME LOAN BANK BOARD, FEDERAL HOUSING ADMINISTRATION, FEDERAL SAVINGS AND LOAN INSURANCE CORPORATION, GOVERNMENTAL NATIONAL MORTGAGE ASSOCIATION, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, NATIONAL SCIENCE FOUNDATION, RENEGOTIATION BOARD, SECURITIES AND EXCHANGE COMMISSION, SELECTIVE SERVICE SYSTEM
Washington GPO 1973 986 p refs Hearings before Comm. on Appropriations, 93d Congr., 1st Sess., 13-16 and 26-27 Mar., 9, 11, 16 and 30 Apr., 1-3, 10, 14-15, 18, and 24 May 1973 2 Vol.
Avail: Subcomm. on HUD-Space-Sci. Veterans
The hearings concerning the appropriations for fiscal year 1974 are reported. Budgets considered include: space shuttle, earth resources program, housing, urban renewal, and SST. F.O.S.

N73-26978# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, SPACE, SCIENCE, VETERANS, AND CERTAIN OTHER INDEPENDENT AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1974. PART 1: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, VETERANS ADMINISTRATION
GPO Washington 1973 937 p refs Hearings before Comm. on Appropriations, 93d Congr., 1st Sess., 13-16 and 26-27 Mar., 9, 11, 16, and 30 Apr., 1-3, 10, 14-15, 18, and 24 May 1973 2 Vol.
Avail: Subcomm. on HUD-Space-Sci. Veterans
The hearings concerning the budget requests for fiscal year 1974 are reported. A comparison of the fiscal year 1973 authorizations and the 1974 budget estimates is included along with summaries of VA hospital activities, and the NASA budget plan. Schedules of planned launches, and NASA activities are included. F.O.S.

N73-26979# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
[CONTINUING STUDIES ON FAST AND THERMAL REACTOR DEVELOPMENT, SAFETY, RADIOACTIVE ISOTOPE PRODUCTION AND APPLICATIONS, AND ACTINIUM PROGRAM] Annual Scientific Report, 1971
R. Billiau, ed., K. Bobin, ed., M. DeCoster, ed., H. Fredrix, ed., and L. Hespeels, ed. 1971 317 p refs
(BLG-467) Avail: AEC Depository Libraries
The various activities of the research center during 1971 are summarized. NSA

N73-26980# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Apparate.
RELIABILITY ASSURANCE FOR COMPLEX SYSTEMS AEROSPACE EXPERIENCE) ZUVERLAESSIGKEITS-SICHERUNG BEI KOMPLEXEN SYSTEMEN - ERFAHRUNG AUS DER LUFT- UND RAUMFAHRT]
Ingo Jaschke 8 Mar. 1972 32 p refs In GERMAN Presented at the Course on Planning, Management and Production in Modern Shipbuilding, 8 Mar. 1972
(MBB-UA-60-72-0) Avail: NTIS HC $3.75
A management concept for reliability assurance is presented. This system was applied successfully to complex aerospace systems and seems suited to modern shipbuilding. The functions of the contractor and contractee, and their collaboration in a large assurance system, are described. ESRO

N73-26981# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRDROP CAPABILITY OF EXPLOSIVE MATERIEL Final Report on Test Operations Materiel
1 Nov. 1972 18 p refs Supersedes AD-718569
(AD-759228; AD-718569) Avail: NTIS CSCL 19/1
The report describes a method for evaluation of explosive loaded materiel during standard airdrop operations. It identifies supporting tests, facilities, and equipment required. It provides procedures for rigging, airdrop, and post drop evaluation and is not applicable to chemical, biological, and radiological munitions. (Author Modified Abstract) GRA

N73-26982# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
AIR FORCE AVIONICS LABORATORY TECHNICAL OBJECTIVE DOCUMENT, FISCAL YEAR 1974, PART 1
John V. Balch 1 Apr. 1973 66 p
(AD-759566; AFAL-TR-73-42-Pt-1) Avail: NTIS CSCL 05/2
Technical Objective Documents (TODs) are prepared by the Air Force Laboratories for distribution by DDC to provide industry with Air Force objectives critical to maintaining aerospace superiority. This TOD prepared by the AF Avionics Laboratory describes the technology planning objectives for meeting future Air Force avionics operational needs. Twelve (12) TPOs relating to the avionics involved in target destruction, penetration survival, information gathering, systems avionics, and avionics technology functions are subdivided into specific goals and further subdivided into technical approaches. These planning categories are taken from the laboratory's annual technology plan. (Author Modified Abstract) GRA

N73-26983# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
[RESEARCH PROGRESS IN GENERAL PHYSICS, PLASMA DYNAMICS, AND COMMUNICATION SCIENCES AND ENGINEERING] Quarterly Progress Report
H. J. Zimmermann, G. G. Harvey, and S. J. Mason 15 Apr. 1973 208 p refs
(Contract DAAB07-71-C-0300)
(AD-759747; QPR-109) Avail: NTIS CSCL 05/2
The report, the hundred and ninth in a series of quarterly progress reports issued by the Research Laboratory of Electronics, contains a review of the research activities of the Laboratory in general physics, plasma dynamics, and communications for the three-month period ending February 28, 1973. (Author Modified Abstract) GRA

N73-26984# Stanford Univ., Calif. Electronics Labs.
[PROGRESS IN PLASMA PHYSICS, INTEGRATED CIRCUITS, SOLID STATE, AND INFORMATION AND DIGITAL SYSTEMS] Semiannual Status Report, 1 Jul. - 31 Dec. 1972
31 Dec. 1972 122 p refs
(Contract N00014-67-A-0112-0044)
(AD-759697; SU-SEL-73-002; SASR-123) Avail: NTIS CSCL 05/2
Contents: Plasma physics and quantum electronics; Radioscience; Integrated circuits; Solid state; Information systems; Digital systems. GRA

N73-26985# Naval Postgraduate School, Monterey, Calif.
PODEMS: A POINT DEFENSE MISSILE SIMULATION
Michael H. Redlin Mar. 1973 73 p refs
(AD-759969; NPS-57RP73031A) Avail: NTIS CSCL 16/2
A Point Defense Missile Simulation has been developed. The report describes the concept of such a missile, the basic features of the simulation program including the integration routine and the jet reaction controllers, and provides a FORTRAN coded source program. Author (GRA)

N73-26986# Defense Documentation Center, Alexandria, Va.
MANAGEMENT INFORMATION Report Bibliography, Nov. 1969 - Oct. 1972
Apr. 1973 268 p refs
(AD-758900; DDC-TAS-73-5) Avail: NTIS CSCL 05/1
The bibliography comprises citations of unclassified reports dealing with management planning and information systems. The following references are on some of the topics dealing with the subject: information systems, management engineering, and management planning. Author (GRA)

N73-26987# Defense Documentation Center, Alexandria, Va.
URBANIZATION AND ITS PROBLEMS Bibliography Report, Aug. 1955 - Mar. 1972
Mar. 1973 274 p refs
(AD-756500; DDC-TAS-72-82) Avail: NTIS CSCL 13/2

The reports in this bibliography consist of urban area problems particularly in the field of urban planning, noise pollution, transportation, and housing. The indexes included are corporate author-monitoring agency, and subject. Author (GRA)

N73-26988# Maryland Univ., College Park. Center for Materials Research.
MATERIALS SCIENCES PROGRAM Annual Technical Report, 1 Jul. 1971 - 30 Jun. 1972
30 Jun. 1972 70 p refs
(Contract DAHC15-68-C-0211)
(AD-760021) Avail: NTIS CSCL 14/2

Research covering chemistry, physics, molecular physics, and chemical, mechanical, and electrical engineering is reported. Specific data cover magnetic, mechanical, optical, and spectroscopic properties of materials including metals and alloys. Material synthesis, structure, and reactions are also discussed. High pressure technology and material damage caused by radiation are included. E.H.W.

N73-26989# Rohr Corp., Chula Vista, Calif.
AIRLINE ECONOMIC IMPACT COMPUTER MODEL. VOLUME 2: APPENDIX, DETAILED DATA TABLES Final Report
Gregory W. Jordan, Sydney X. Smith, William L. Metzger (Mitchell Res. Assoc.), and Ralph C. Gibson (Mitchell Res. Assoc.) Jun. 1972 181 p
(Contract DOT-FA72WA-2699)
(AD-749491; FAA-EQ-72-4-Vol-2) Avail: NTIS CSCL 01/3

The report is the Appendix to Airline Economic Impact Computer Model, Volume I - Detailed Discussion. It contains summary computer output for 12 sample cases. The purpose of the model is to provide the Federal Aviation Administration with an effective procedure to rapidly and reliably determine the economic impact on the U.S. airline industry of an aircraft sound suppression retrofit program under a wide variety of reasonable assumptions and alternatives. The model is capable of handling 20 airlines, 15 aircraft types, and 20 years. The major computational areas of the model are: airline traffic, revenue, investment base, direct operating expenses, retrofit kit cost, change in direct operating cost due to retrofit, required capital and change in investment base due to retrofit, critical route revenue loss due to retrofit, indirect operating costs, airline rate of return on investment and fare elasticity of traffic demand. Author (GRA)

PUBLIC COLLECTIONS OF NASA DOCUMENTS

DOMESTIC

NASA deposits its technical documents and bibliographic tools in eleven special regional libraries located in the organizations listed below. Each library is prepared to furnish the public such services as reference assistance, interlibrary loans, photocopy service, and assistance in obtaining copies of NASA documents for retention.

CALIFORNIA
University of California, Berkeley
COLORADO
University of Colorado, Boulder
DISTRICT OF COLUMBIA
Library of Congress
GEORGIA
Georgia Institute of Technology, Atlanta
ILLINOIS
The John Crerar Library, Chicago
MASSACHUSETTS
Massachusetts Institute of Technology, Cambridge
MISSOURI
Linda Hall Library, Kansas City
NEW YORK
Columbia University, New York
PENNSYLVANIA
Carnegie Library of Pittsburgh
WASHINGTON
University of Washington, Seattle

NASA publications (those indicated by an "*" following the accession number) are also received by the following public and free libraries:

CALIFORNIA
Los Angeles Public Library
San Diego Public Library
COLORADO
Denver Public Library
CONNECTICUT
Hartford Public Library
MARYLAND
Enoch Pratt Free Library, Baltimore
MASSACHUSETTS
Boston Public Library
MICHIGAN
Detroit Public Library
MINNESOTA
Minneapolis Public Library
MISSOURI
Kansas City Public Library
St. Louis Public Library
NEW JERSEY
Trenton Public Library
NEW YORK
Brooklyn Public Library
Buffalo and Erie County Public Library
Rochester Public Library
New York Public Library
OHIO
Akron Public Library
Cincinnati Public Library
Cleveland Public Library
Dayton Public Library
Toledo Public Library
OKLAHOMA
Oklahoma County Libraries, Oklahoma City
TENNESSEE
Memphis Public Library
TEXAS
Dallas Public Library
Fort Worth Public Library
WASHINGTON
Seattle Public Library
WISCONSIN
Milwaukee Public Library

An extensive collection of NASA and NASA-sponsored documents and aerospace publications available to the public for reference purposes is maintained by the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, New York, 10017.

EUROPEAN

An extensive collection of NASA and NASA-sponsored publications is maintained by the British Library Lending Division, Boston Spa, Wetherby, Yorkshire, England. By virtue of arrangements other than with NASA, the British Library Lending Division also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols "#" and "*", from: ESRO/ELDO Space Documentation Service, European Space Research Organization, 114, av. Charles de Gaulle, 92-Neuilly-sur-Seine, France.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

SPECIAL FOURTH CLASS MAIL
Book

POSTAGE AND FEES PAID
NATIONAL AERONAUTICS AND
SPACE ADMINISTRATION
NASA-451

883 1 STAR 730830 S01733HU
UNIV OF MICHIGAN
GENERAL LIBRARY
SERIALS & DOCUMENT SECTION
ANN ARBOR MI 48104

NEW NASA PUBLICATIONS

The NASTRAN Theoretical Manual (Level 15.0) (NASA SP–221(01))
The NASTRAN User's Manual (Level 15.0) (NASA SP–222(01))
The NASTRAN Programmer's Manual (Level 15.0) (NASA SP–223(01))
NASTRAN Demonstration Problem Manual (Level 15.0) (NASA SP–224(01))

These manuals replace and supersede the previous level 12.0 documents. Loose leaf. 638, 1262, 2238, and 210 pages, respectively. For sale by the Computer Software Management and Information Center (COSMIC), Barrows Hall, University of Georgia, Athens, Georgia 30601, for $6.00, $10.00, $27.50, and $3.00 respectively, or $46.50 for the set.

Bioastronautics Data Book. Second Edition (NASA SP–3006)

This revision of the *Bioastronautics Data Book* represents an updating and expansion of a 1964 NASA document. The Second Edition was prepared under the guidance of Working Group 5 of the Committee on Hearing, Bioacoustics and Biomechanics of the National Academy of Sciences in order to bring together the essentials of the large body of human research information generated in recent years and to present it in a form suitable for engineers and others concerned with the development and evaluation of modern systems. The book deals with a substantial array of content areas within the broad domain of life sciences and presents primarily that information deemed of value for system design and evaluation. *Clothbound.* 948 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $7.50.

Scientific and Technical Information Office
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
***Washington, D. C.* 20546**